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VOL. XI. NEW YORK, JAN. 28, 1888. No. 4.

An Electric Pinwheel Arc. THE incandescent lamp "freak," described in our columns recently has brought out the fact that the occurrence is one which may be looked for and is the result of the faulty shape of the globe, when the latter is made to approach too near to the heated filament. A contributor on another page describes his experience in this line, and adds another curious incident witnessed in experimenting with incandescent lamps. The phenomenon observed by him was probably due to the air currents flowing into the lamp, as he describes.

Anticipations in Thermo Electricity. IT was, perhaps, to be expected that the apparatus used by Mr. Acheson for generating electricity direct from heat, as described by us recently, would call forth "anticipations," and one of these is now drawn attention to in our columns by Mr. R. M. Hunter. A comparison of the two apparatuses of Mr. Hunter with one of those designed by Mr. Acheson shows considerable similarity between the two. It will be noted that Mr. Hunter does not place much value upon this method of generating electricity, but merely looks upon it as an interesting experiment.

Higher Cable Rates. NOBODY who has at all studied the subject ever supposed that the cable companies could make money at 12 cents per word, and though vague assertions have been made to the contrary, Sir John Pender now admits that the lowest profitable rate is, and should be, 25 cents. The 12 cent rate has been useful in an educational way. It has induced many people to use the cable who will not now drop the habit, and it has taught the cable companies better methods, as well as put their administrative and technical skill to its highest test. The hope may be expressed that the 25 cent rate will soon be made the rule. It is little enough for quick and accurate service.

Subway Accidents. ONE of the chief troubles connected with subways for electrical wires is already beginning to manifest itself in this city, in the filling of the conduits with illuminating gas that has escaped from leaky mains. For some time past the condition of the Western Union building, where gas has filtered in from the subways, has been most disagreeable, and no remedy has been found; and now gas has killed a man working in a manhole uptown. Of course, the man and his fellows should have been more careful, but we are afraid that there will be more accidents before many months have passed, and this from no fault of the subways. Our readers will remember the series of explosions in Philadelphia not long ago, and there is little ground for supposing that New York will be luckier.

Telephone versus Telegraph. A story that was not wanting in circumstantiality went the rounds last week to the effect that the American Bell Telephone Company and Western Union Company were at loggerheads, and that the invasion of the telegraph field by the telephone was leading to open warfare. So strained had relations already become, that the Western Union Company had begun negotiations for the purchase of the McDonough telephone, said to be owned by Mr. H. H. Eldred, but actually in the possession, we believe, of Mr. Stokes and his Postal associates. The report has been flatly contradicted, and it is affirmed that the two great corporations are in perfect accord in every particular, although it is admitted that their presidents were lately in conference together for some time. It is possible that the rumors have arisen out of the general and reasonable belief that the continuous and steady extension of long distance telephone lines must in time lead to a rupture or to a readjustment of old terms and contracts. Long distance telephony is, thanks to the care and ability with which it has been established, a marked and even brilliant success. We never use the lines ourselves without intense gratification at the ease with which conversation over them can be carried on, and it is no wonder that the resort to such service, instead of to private telegraph wires, is becoming so common. With such lines at command, the arbitrary distinctions between telephone and telegraph business are apt to be wiped out or practically disregarded.

The Inefficiency of Postal Telegraphs. THE Post Office Committee of the United States Senate has begun to take "evidence" on the subject of government telegraphs. No session of Congress is now considered complete without this proceeding. The committee has had the evidence of two distinguished witnesses, Dr. Norvin Green and Mr. G. G. Hubbard, both of whom have been similarly engaged before, on opposite sides of the question. Dr. Green took a bold stand. He denied that the Western Union Company was a telegraph "monopoly," though if it be not, some new definition of the word must be found. Still he made some good points, in showing how large a number of persons hold stock in the company and in pointing out the undeniable fact that as a rule the aggregation of capital in large enterprises cheapens production and thus tends to the public welfare. One weighty argument against taxing the whole community for government telegraphs is his remark that 90 per cent. of the business was done for the exchanges and the newspapers. He did not hesitate to allege, moreover, very broadly, that government telegraphs were everywhere inefficient as compared with the American service, as well as dearer. Mr. Hubbard held that as so many other countries had found it wisest to control the telegraph, so in America that would be the only solution of the problem, and he favored a plan which should give the government power to contract for the transmission of telegrams, but should leave it to deliver the telegrams as it does letters. Mr. Hubbard also pointed out that while abroad 80 per cent. of the business was "social," here only 5 per cent. of it was of that character, the inference being that the existing conditions were against the universal use of the telegraph. Perhaps the most practical part of the whole session was the eliciting from Dr. Green the statement that telegraph rates are to be reduced again this year.

Improvements in Storage Batteries. THE new arrangement of storage cell, described in another column, is somewhat significant of the fact that the things to be observed in the storage battery, and which are well known, have not yet been thoroughly applied in practice. Thus in the first place it is well known, that in order to obtain uniform action over the entire surface of the plates, they should conduct current equally well in all their parts. But with a connection made at one end only, as usually done, this rule is to a considerable extent violated, with the result that the parts of the plate distant from the one connection, receive comparatively little current, as they are in a position offering greater resistance than the parts nearer the connection. Hence we note as one of the improvements in the new cell the connection of the negative plates, among themselves, at five different points instead of one, as heretofore, and of the peroxide plates at three points. We note also that, in order to prevent any possibility of a short circuiting taking place between the plates by the dropping out of the active material, the plates are separated to such an extent that the retention of such material is no longer possible. While this greater separation of the plates may increase the internal resistance of the cell somewhat for a given capacity, the precaution and safety effected by this change appear nevertheless to be warranted. It will also be seen that the lower edge of the plates is now raised some distance above the bottom of the cell, so as to prevent short-circuiting at that point by any material dropping from the positive plates. We find in this construction the evident outcome of experience, and while it may be argued by some that such a construction indicates the still-existing weaknesses of storage batteries, on the other hand it demonstrates the easy finding of a natural remedy for a defect.

New Portable Alternating Current Measuring Instruments. AMONG the most prominent of those to design instruments for the use of electrical engineers of the new school, instruments which were designed to be direct reading and portable at the same time, are Professors Ayrton and Perry. Their earliest instruments were adapted only for continuous current measurement, but with the practical advent of the alternating current it is not to be wondered at that they sought to obtain an instrument which should be reliable as well as portable for that. In the construction of the new instrument, they have utilized their old magnifying spring, and have made its deflections dependent on the expansion of fine platinum wires, as in that of Captain Cardew; but they have avoided some of the disadvantages connected with the latter. The advantages of the new instruments need not be enumerated here, but attention must be drawn to the laws arrived at by Professors Ayrton and Perry in their investigation of the action of their instruments. Thus they show that to raise a fine wire of a given length, made of a given material, to a given temperature above that of the case of the instrument, requires that the potential difference maintained at the ends of the wire shall be inversely proportioned to the diameter of the wire, approximately. And again, as a sort of corollary to the above, they find that the current required to maintain a fine wire, of a given material, at a definite excess of temperature, is approximately directly proportional simply to the thickness of the wire. These laws are very interesting, and may, it seems to us, be applied in other ways than in the construction of measuring instruments. It would be interesting to note, for instance, whether it holds true in the case of the carbon filaments of incandescent lamps, or, in other words, it would be interesting to know up to what limits of thickness of wire the law holds.

Professor Elihu Thomson's Alternating Current Indicator. WHILE the study of the phenomena of alternating currents is greatly facilitated by the representation of the varying electromotive forces, by means of curves, the assumptions thus far made regarding the action of circuits carrying alternating potentials have been based mostly upon theoretical considerations, and were the results of theoretical analysis. It is evident, however, that if the exact value of the alternating current potential at every instant could be definitely learned, our knowledge of the construction of alternating machines would be greatly increased. Prof. Elihu Thomson, who has already accomplished a large amount of original work in this new field, has now placed at our command an apparatus which fulfills the object just mentioned. As described in another column by himself, Prof. Thomson has utilized the well-known sensibility to vibration of the telephone diaphragm for the purpose of conveying motion to a reflecting surface which gives to a spot of light a travel which is an exact portrait of the varying strengths of the current, laid out in the shape of a curve, so that it can be studied at leisure. Although this method of obtaining graphic representations of right line movements is not new in itself, its application as well as the apparatus designed by Prof. Thomson for this purpose, evidences a high degree of originality, and it is safe to assert that by this means the alternating machine, as well as alternating current apparatus of all classes, will be improved and made to conform to standard values. Although it may be argued by some that the deflections of the diaphragm are not exactly proportional to the E. M. F.'s energizing the coil, still this, even if true, would by no means vitiate the value of the apparatus, for, what is desired to be obtained by its means is not the absolute value of the electromotive force, but its relative value at each instant of time. Hence, even if the curve were exaggerated in certain parts, its general contour would nevertheless show the actions going on in the apparatus which energizes the core opposite the diaphragm. It is this, primarily, for which the instrument is designed, and which it accomplishes fully, as shown in actual tests.

NEW BOOKS.

FIRST STEPS IN ELECTRICITY. By Charles Barnard. New York: Charles E. Merrill & Co. Illustrated. 133 pp. 5 × 7¼. Price, 75 cents.

This is a neat little practical work on elementary electricity, and none the less valuable because it is unpretentious. Mr. Barnard has done much to popularize science from time to time, and this last effort of his deserves a cordial recognition. In the hands of an intelligent and inquiring child, the book cannot but be productive of good, and we can well imagine that even adults uninformed on electrical subjects may derive instruction from its pages. The various experiments illustrative of the principles to be understood are carefully described and explained, and the phraseology is so plain and pointed that there is no fear of ambiguity. In order to assist those who wish to try the experiments for themselves, the publishers have prepared an outfit at a nominal price, comprising most of the articles mentioned.

THE ART OF PROJECTING. By Prof. A. E. Dolbear. M.E., Ph. D. Boston. Lee & Shepard: Illustrated. 178 pp. 5¼ × 8. (Second Edition.)

Although this book was first published some ten years ago, it has not become antiquated, and in preparing the second edition Prof. Dolbear has added useful matter giving it freshness and value, and in reality bringing its information down to date. This remark applies specially to the new section on "Electric lights for projection," in which some pithy information is given on the subject. That portion is followed, too, by other new matter with regard to vortex rings and their phenomena. Altogether the work is one that will be of interest to a great many electricians and students in physics.

ANIMAL MAGNETISM. By A. Binet and C. Fere. New York: Appleton & Company. International Scientific Series, vol. 59. Illustrated. 378 pp. 5 × 7¼. Price, $1.50.

In many ways this is a very interesting and suggestive volume. The authors have had unusual opportunities of study in this mysterious field of "animal magnetism" at the celebrated Salpetrière Hospital, and their personal observations herein recorded were made in accordance with the method of M. Charcot, whose work has attracted much general interest.

As the writers say, it is still too early to write a didactic treatise on animal magnetism and hypnotism, as it is to formulate theories on the subject. The book takes us back to the beginnings of modern animal magnetism, in the days of Mesmer, Deslon and Puysegur, when Franklin was among those who investigated officially the effects of the famous *baquet*, and comes down to the present forms of it as exemplified in the work of Charcot and his associates. Much curious information is given as to the production and effects of hypnotism, and we find various strange results attributed to the interposition of the magnet. We will not attempt to settle the question, but we will leave readers of the book to determine for themselves, if they can, how much difference there is between the old circular trough of Mesmer, with its bottles and powdered glass and iron filings, and the present use of the magnet in modifying disease or in transferring sentiments and emotions from one person to another. The science of magneto-therapeutics is certainly still in its infancy, but if it can give us new moral agents and effect the reform of every criminal, let it be developed by all means. We notice that a special commission has just recommended the application of large doses of electricity as a sure cure for murder, but it would evidently be an improvement to prevent murder by the laying on of magnets. And yet here again a difficulty arises, for if it be true that the magnet can transfer praiseworthy sentiments from one being to another, it can also be used for bad purposes the other way.

Electricity Direct from Coal.

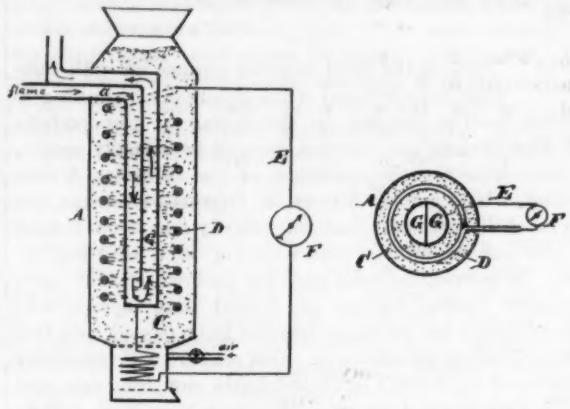
BY R. M. HUNTER, M. E.

The subject of generating electricity direct from heat has of late obtained such prominence that it may be of interest to the readers of this journal to describe some of the apparatus designed for this purpose by the writer as far back as 1881. Fig. 1 shows one of his generators, consisting of a sheet metal shell *A*, containing carbon *C* in a powdered condition. A flame from a furnace or fire passes through tube *G*, and heats the carbon. Surrounding *G* and embedded in the carbon *C*, and within the shell *A*, is a coil of heavy wire *D*, which is connected at one end to the circuit *E*, containing the translating device *F*, and connecting at the other end with the conducting case or tube *G*. The electrical circuit is completed through the carbon and gases evolved from its slow oxidation.

Fig. 2 is a sectional plan view showing the coil *C* more plainly. In operation, the gases evolved surround each particle of carbon and such gases and carbon act as the conductors; and the results are naturally best when the difference between the temperatures of *D* and *G* is greatest.

In Fig. 3 there is shown another type of generator in which one conductor *J* is not in contact with the carbon, but is enveloped in the oxide gases evolved therefrom. In this construction a casing *H* of terra cotta was placed within a heating shell *L*, and contained an inner perforated terra cotta tube *I*. Between the parts *H* and *I* carbon *C* was placed and also a plate *K* shown in perspective in Fig. 4, embedded in the carbon. A conductor *J* was suspended in the tube *I*, *J* and *K* were connected by circuit *E* with translating device *F*. The gases evolved from *C* passed into the tube *I* and heated the conductor *J*.

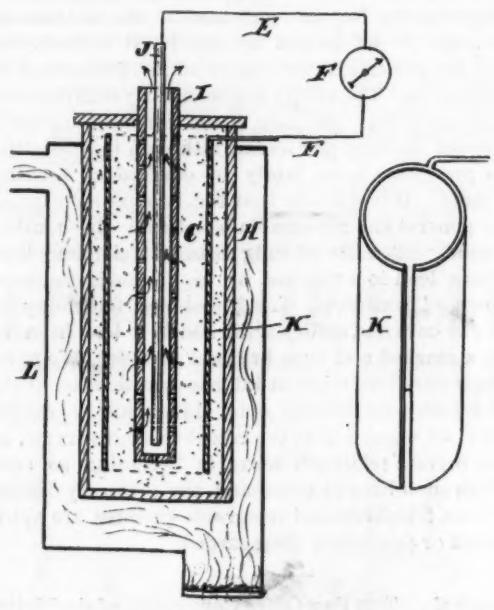
In Fig. 5 the circuit terminated in two coils, one in a



FIGS. 1 AND 2.—ELECTRICITY DIRECT FROM COAL.

bed of powdered carbon undergoing slow combustion, and the other in the atmosphere of the oxide gases evolved therefrom; the carbon taking the place of the zinc in a galvanic battery and the oxide gases performing the function of the oxidizing solution.

These inventions were made by the writer in the year 1881, when actively engaged in the electric lighting and



FIGS. 3 AND 4.—ELECTRICITY DIRECT FROM COAL.

motor business, and were the outcome of some scientific investigations he was carrying on as to the production of electricity from the slow oxidation of dry carbon. He was at that time engaged in writing a work on the generation of the electricity of the human system from the oxidation of the carbonaceous tissues or fatty organization of the body. These facts may be of interest to the readers

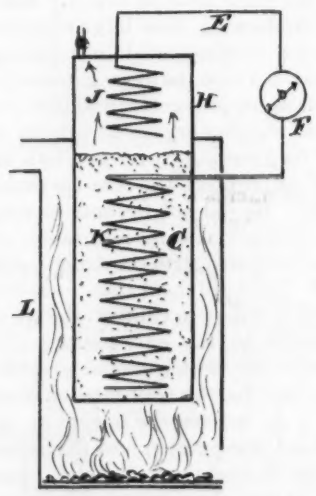


FIG. 5.—ELECTRICITY DIRECT FROM COAL.

of THE ELECTRICAL WORLD. While the writer does not put much intrinsic value upon the inventions, he believes that he may venture to say that he was probably the first to investigate this field.

National Electric Light Association.

To the Editor of The Electrical World:

SIR: Please announce through your columns that Mr. Geo. F. Porter, No. 1,112 Arch street, Philadelphia, will make the necessary arrangements in regard to railroad rates for the Eastern members for the next meeting of the National Electric Light Association in Pittsburgh.

Any one desiring information will please communicate with Mr. Porter.

S. A. DUNCAN,
Chairman Executive Committee.

Electric Traction Calculations.*

BY A. T. SNELL.

The following table will be found very useful in making calculations connected with electric (or other) traction:

TABLE

Giving miles per hour in feet per minute and per second.

Miles per hour.	Feet per minute.	Feet per second.	Miles per hour.	Feet per minute.	Feet per second.
1	88	1.46	16	1,408	23.47
2	176	2.94	17	1,496	24.93
3	264	4.4	18	1,584	26.4
4	352	5.87	19	1,672	27.86
5	440	7.33	20	1,760	29.33
6	548	8.8	21	1,848	30.8
7	616	10.26	22	1,936	32.26
8	704	11.73	23	2,024	33.72
9	792	13.2	24	2,112	35.2
10	880	14.67	25	2,200	36.67
11	968	16.13	26	2,288	38.14
12	1,056	17.6	27	2,376	39.6
13	1,144	19.07	28	2,464	41.04
14	1,232	20.52	29	2,552	42.50
15	1,320	22.	30	2,640	44.0

Formula for calculating the horse-power required to propel any vehicle:

$$H.\ P. = \frac{W\ K\ S}{33{,}000} \pm \frac{W\ 2{,}240\ S}{33{,}000} \sin \theta.$$

where W = total rolling load in tons,
K = resistance to motion expressed in lbs. per ton,
S = speed required in feet per min.,
θ = the inclination of the grade.

The value of S corresponding to any number of miles per hour can be filled in from the table. K can only be determined by experiment, but approximate values can be found in the usual text books. For raised rails K varies from 12.5 lbs. to 20 lbs.: for sunk rails, from 28 lbs. to 56 lbs. will be fair limits under ordinary working conditions. On inspection, it will be seen that the first fraction in the equation gives the horse-power required to overcome the resistance to traction on the level only, while the right-hand quantity is a measure of the work done either against, or by, gravity; hence the double sign, ±. The term will be negative on a down-grade, and positive on an up-grade. If the gravity term exceed the traction term and have a negative sign, the equation becomes negative. This means that the car will travel by the aid of gravity alone. The use of the table and formula will be best seen from an example:

Let $K = 30$, $W = 8$ tons.
Speed = 10 miles per hour,
$\therefore S = 880$.
And, let $\sin \theta = \frac{1}{50}$;
or, $\theta = 1° 9'$.

Suppose the gradient is against the load, we have

$$H.\ P. = \frac{8 \times 30 \times 880}{33{,}000} + \frac{8 \times 2.240 \times 880 \times 1}{33{,}000 \times 50}$$
$$= 6.4 + 9.5 = 15.9.$$

Amyloid Carbon for Incandescent Lamps.

Writing on the subject of the converting effect of the acid on cotton thread in the manufacture of incandescent lamps, Mr. N. K. Cherrill, in the London *Electrician*, maintains that the process as carried out commercially contains in its very essence the germs of failure. He says:

If the action of the acid is cut short of complete conversion, the cotton may have still more of the characteristics of the fully converted article. It will still have the appearance of catgut, and will cut easily in the dies used to reduce its diameter; but on examination under the microscope, or a strong lens, it will be seen still to retain evident traces of fibrous form; the original twist of the cotton will be often seen indicated by lines in the substance of the thread. If, now, such a sample of cotton be more fully converted, it will most likely be found to be quite cleared from the traces of fibrous form; but at the same time there are ten chances to one the cotton will be made too weak to draw through the dies, and it will consequently be condemned as rotten. In fact, to put the matter in a nutshell, if the acid treatment is prolonged to that point at which absolutely no fibrous traces remain, the cotton is generally too weak to draw well. The tendency of manufacture is therefore decidedly to use cotton too little rather than too much prepared. Now suppose that we carbonize a piece of quite unprepared cotton thread and examine the result in the microscope, we shall find a loose aggregation of cotton fibres having no cohesion one with another. If a piece of such a carbon filament be placed in a compressor (such as a tin box or lever compressorium) under the microscope, the various carbon fibres will be seen to move about among each other when the pressure of the covering glass is varied. When by the action of the acid the cotton fibres are, as it were, glued together, the resulting carbon presents under microscopic examination a like homogeneity of substance; but it is easy to see that if the action of the acid has been at all cut short of the most complete conversion there must always be a tendency for the inner fibres to be left loose in the burning, and hence I take it

*London Electrician.

that in any thread which shows any sign of structure there is a serious liability for the lines which indicate structure to develop under firing into lines of imperfect homogeneity. It is impossible to judge of this point in the microscope, but the behavior of the carbons when a current is passed through them may often be taken as an indication of their structural condition.

Electric Wave and Phase Indicator for Alternating and Undulatory Currents.

BY PROF. ELIHU THOMSON.

The purpose of the instruments designed by the writer and to be presently described is to enable us to study the shapes of the waves of alternating currents produced by

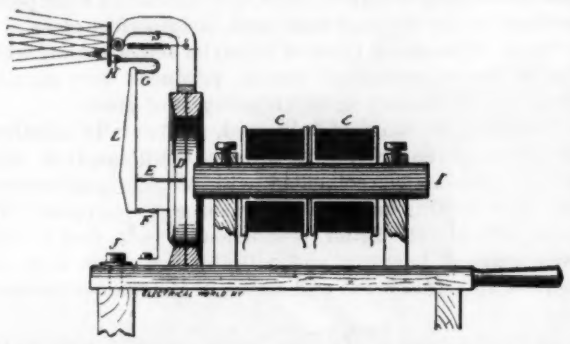
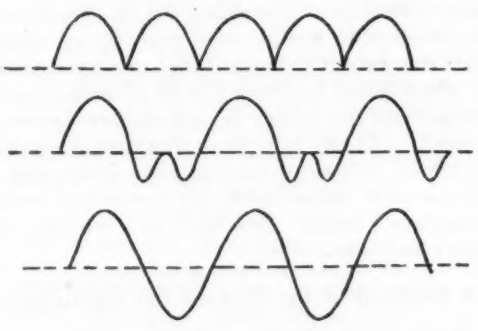


FIG. 1.—ELECTRIC WAVE AND PHASE INDICATOR FOR ALTERNATING AND UNDULATORY CURRENTS.

different machines and apparatus, and also to study the relations of waves in different branches or portions of an alternating current circuit, so that the amount of lag or retardation of phase may be visibly noted.

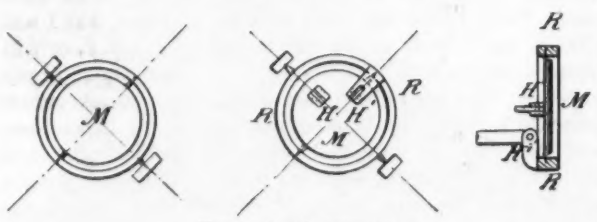
The instruments grew out of the use of cruder apparatus employing the manometric flame principle to study the undulations or vibrations of currents. The manometric flame apparatus, which was made about a year ago, differed from that used in the study of sound waves in having an iron diaphragm instead of the flexible diaphragm which closes the gas space, and the movement of which, in such apparatus, resulting from the impingement of



FIGS. 2, 3 AND 4.

sound waves thereon, gives rise to differences in the height of a flame jet fed by the gas; which differences or variations of height of flame were noted in a revolving mirror in the usual way. The iron diaphragm of ferrotype metal was placed in front of a bundle of iron wires around which and through a coil in the circuit to be tested the alternating currents passed.

The results obtained with the manometric flame apparatus were only approximate and subject to a number of inconveniences common to such arrangements. It was found better to utilize the movements of the flexible diaphragm, carried through proper lever connections, to give



FIGS. 9, 10 AND 11.

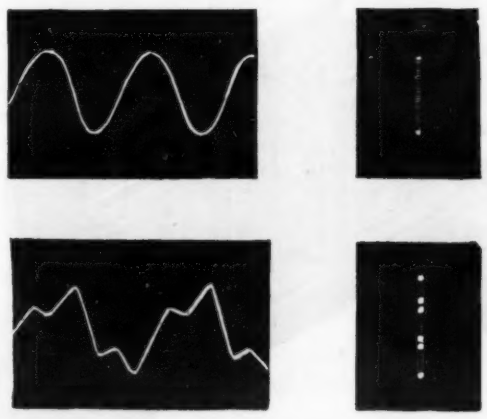
a swinging or oscillatory motion to a small mirror, whereby a beam of light thrown upon the mirror and focused so as to produce a spot of light on a screen at some distance therefrom, might be caused to trace out the shape of the wave, and either the eye used directly to examine the wave-like image or a sensitive plate employed for photographing or rendering it permanent.

The apparatus containing a single diaphragm and connections is shown in Fig. 1. An iron wire core or bundle *I* is mounted on a stand and arranged so that coils *C*, *C*, the number of convolutions of which may be made especially to suit the conditions of each experiment, can be placed upon the core. Sometimes these coils are made with multiple or parallel windings so that two or more sets of current waves may be caused to act upon the core *I* simultaneously. One of the coils or one of the windings may, when needed, be used to polarize or magnetize the core *I* with a definite strength of magnetism, as by a battery current or other continuous current. A diaphragm suitably mounted in front of one end of the core *I* and constructed of ferrotype metal follows closely the fluctuations of magnetism produced in the core by the currents in the coils. The distance of the core *I* from the diaphragm can be adjusted. From the middle of the diaphragm a short aluminum wire, flattened out at *E* so as to be very flexible at that point and connected to a very light but stiff aluminum lever *L*, conveys the movements of the diaphragm to the latter. The lever *L* is constructed of flat metal and placed, as shown, so as to obtain the greatest stiffness with the least weight.

The fulcrum at *F* is composed of a flattened place in the metal wire, so that it has no lost motion. The connection of the long arm of the lever *G* has also a flattened place in the wire, and a delicate pivot *H* connects and conveys the movement of the lever *L* to the small circular mirror *M*, mounted on a transverse axis and held down against the pivots so as to avoid lost motion by a spring *S* attached to the middle of the back of the mirror and pulling on the same. The pivotal point *H* is put a little to one side of the axis on which the mirror swings.

Now, it will be evident by this construction that the slightest movement of the diaphragm *D* will be followed by a much magnified movement of the mirror *M*, which mirror, receiving a ray of light, will, as it changes its position, cause such ray to swing over a considerable space on a screen at a distance of 18 or 20 inches away. The beam of light is obtained from a small illuminated pin hole reflected and focused upon the screen, placed in front of the mirror at, say, a foot or 18 inches therefrom; any movement of the mirror will therefore cause this small round spot to travel up and down in accordance with such movement.

If one of the coils of such an apparatus be traversed by alternating currents and the whole apparatus be arranged to swing in a horizontal plane on a vertical axis or pivot at *J* just vertically under the mirror *M*, the spot of light will trace out a curve which will approximate closely to the shape of the current wave, much depending on the perfection with which the apparatus has been constructed for the avoidance of much inertia, by making the parts very light, and for the avoidance also of disturbing effects



FIGS. 5, 6, 7 AND 8.

by having the diaphragm *D* traverse but a very small distance to and fro in front of the core *I*.

As the core *I* is of soft iron, unmagnetized, both the negative and positive impulses of current produce movements of the diaphragm towards the core, one by developing north magnetism and the other by developing south magnetism at its extremity near the diaphragm. The alternating current will therefore produce a wave line like that seen in Fig. 2, in which the dotted line is the zero of current and the curve of the waves rising therefrom are produced by currents alternately in opposite directions. If, however, a continuous current be passed through one of the coils around the core, and the strength of this current gradually increased, the shape of the wave will undergo considerable alteration, and in one stage will be represented by the wave line shown in Fig. 3, which represents the case of an alternating current passing at the same time with a continuous current in another coil, which continuous current is insufficient to so fully polarize the core *I* that the diaphragm *D* cannot be attracted by both impulses. The small wave between the larger waves is an effect produced by the overpowering of the continuous current by the stronger opposite alternating impulses, while the larger waves are due to the combined attraction of the continuous current and the alternating impulses which pass in the same direction around the core. If, however, as in Fig. 4, the polarizing or continuous current be made slightly stronger, the wave takes a shape in which the opposite impulses are represented by opposite movements or in which the upper half of the wave line represents a current in one direction and the lower half the flow of current in the other direction, except in so far as the shape may be modified by the action of the diaphragm itself. The actual appearance presented will be that shown in Fig. 5, in which the curved line is on a black ground, the apparatus, of course, being inclosed in a dark box with an opening opposite the screen for viewing the tracing of the spot of light.

If no movement in a horizontal plane be given to the apparatus, the spot of light simply describes a vertical line whose upper and lower extremities are much brighter than the middle, Fig. 6, because of the stoppage of direction of motion which occurs in the spot of light at the upper and lower points of its swing, and of the fact that the highest velocity of traverse exists in the middle of the swing or when the current is changing from positive to negative or the reverse. The appearances presented in Figs. 2 to 6, inclusive, are like those which were obtained from an alternating current machine, the armature of which was without iron projections, such machine being one used in lighting by transformers. Fig. 7 shows a wave line such as was produced by an alternating current dynamo having iron projections on the armature core. Here, it will be noticed, the curve is of irregular form, though regular in its irregularity. The curve indicates the sudden jumps of E. M. F. at the conclusion of each

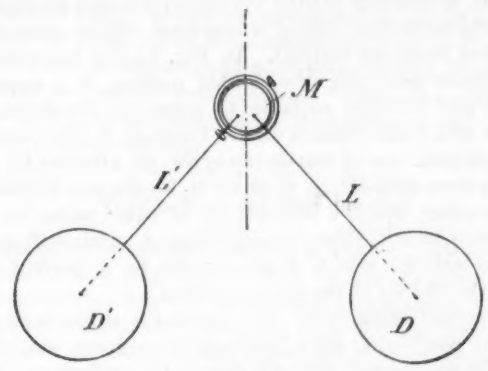


FIG. 12.

current wave, and this was undoubtedly due to the forcible pulling away of the armature projections from the field, causing, as a result, a far more rapid passage of magnetic lines across the armature conductors to the next succeeding projection; that is, the magnetism of the field on leaving one projection may be considered to quickly swing over to the succeeding projection, irrespectively of the movement of the armature, and at the same time cut all the wire between the two projections, and thus give rise to a jump or strong impulse of E. M. F.

Comparing the curves, Figs. 5 and 7, it will be seen that the armature without projections has given a more per-

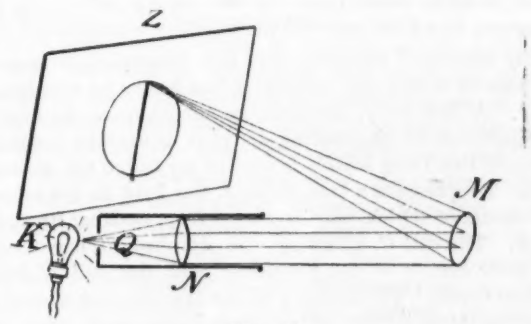


FIG. 13

fect wave and that the induction is much smoother, no irregularities of E. M. F. showing themselves. Fig. 8 shows the appearance presented by the spot of light with the same current as in Fig. 7, but with no lateral or horizontal movement given to the mirror. In this case, as in Fig. 6, the spot shows a vertical image or bright line, but instead of the upper and lower extremities being the only points of the line which are bright, the line shows a tendency to the formation of bright spots at other points in its length, and these correspond with those positions in the wave

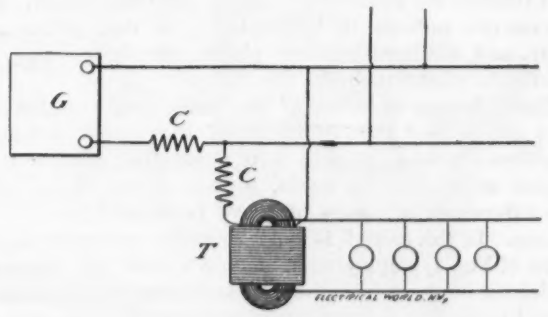


FIG. 14.

at which the spot of light either hesitates or changes its direction of movement. In fact, the appearance, Figs. 6 and 8, is as though the waves, Figs. 5 and 7, were composed of a wavy band of light, and were seen on end or in the plane of their propagation.

The apparatus with a single movement of the mirror, Fig. 1, is not well adapted to the study of the relations of the position of phase of two alternating currents, but by adding an additional core with its coils, and an additional diaphragm and lever, and connecting the second set so as to impart a motion to the mirror at right angles to that given by the first set, the capabilities of the apparatus are much extended. The mirror for this purpose is mounted in gimballs, as in Fig. 9, and a connection made from one lever which receives its motion from one of the diaphragms to the mirror, as in Fig. 1, and from the other lever and diaphragm to the surrrounding ring *R*, Fig. 10, by an attachment *H'*. Fig. 11 shows the back of the mir-

ror with the attachments *HH'*, for the two levers. These attachments are preferably made at equal distances from the centre of the mirror, so as to give the vibrations of the two diaphragms a nearly equal value in changing the position of the mirror. All of the moving parts are made as light as is consistent with proper rigidity.

Fig. 12 shows the arrangement of the diaphragms and levers in giving movement to the mirror *M*. Now, if the same current or currents of exactly matched phases act to move both diaphragms, and the angular deviations of the mirror be balanced or equal, the mirror will cause the spot of light to travel in a straight line intermediate to the two combined movements given by the two levers. In this case, as shown in Fig. 12, the spot of light will move in the direction of the vertical dotted line.

If, however, the phases of the alternations do not match, or one lags behind the other, the spot of light will describe an ellipse, one of whose axes will be more or less inclined from the vertical. In Fig. 13 *Z* is the screen, *M* the mirror receiving the double motion, *K* a source of light, and *N* a lens suitable to form on the screen *Z* an image of a small pinhole at *Q*. Further, if the condition be such that one of the diaphragms be affected by a current whose retardation of phase is 90 degrees behind that of the other, and the currents be of equal value in moving the mirror, a figure approaching a circle will be seen on the screen, which figure would be a perfect circle were the shapes of the waves perfect.

In actual trials with the apparatus it has been found that by combining the effects of alternating currents in circuits and branch circuits, a variety of figures, mostly ellipses, the relation of the length of whose axes varied greatly, and the inclination from the vertical of the axes of which also varied greatly, were produced. The changing position of the axes of the ellipses with respect to the vertical, if properly noted, gives an indication of the amount of angular lag or retardation of phase existing in one current as distinguished from the other.

It may be objected that the apparatus itself, on account of its inertia, must give rise to a retardation of the record, but it will be seen that the two diaphragms, levers, etc., being substantially the same in character and dimensions, the interia or retardation will be practically a constant effect, and that any difference existing can be eliminated by exchanging the currents from one coil and diaphgram to the other, so as to cause them to alternately affect the diaphragms, in which case the mean effect would be taken.

It is outside of the purpose of this description to note all the uses to which this apparatus has been and may be applied. A few may, however, be mentioned. In Fig. 14, *G* represents an alternating current generator feeding a primary line from which branches are taken off at intervals. *T* represents a transformer, the load in the secondary circuit of which may be varied from nothing up to full work. The coil *C*, affecting one diaphragm, is placed in the main circuit of the generator, and the coil *C'* in the branch through the primary of the transformer affects the other diaphragm, the adjustments being made such that the vibratory effects of each, or the amplitude given to the wave movements of the spot of light by each are equal. In an actual case of this kind it was found that the transformer under no load gave nearly a circle, and therefore showed that the currents passing through the primary had a lag or retardation of approximately 90°, or one-quarter of a wave length, and this condition was departed from or modified by throwing on the load in the secondary. Space does not permit a full description of the actions, which were, however, very interesting.

Comparisons are also easily made with this apparatus between the positions of phases of the secondary currents and those of the primary currents in the transformer. By the use of a sufficiently bright light, as that of an arc lamp, and sensitive gelatine plates, the figures may, of course, be photographed.

The apparatus in either of its forms, single or double, may also be used as an indicator of the extent to which synchronism takes place in two alternating current machines or sources; or, again, it may be used to indicate the differences of shape of wave produced by such machines. In this case it is only necessary to use the apparatus of Fig. 1, employing a double wound coil through which the currents from the two machines pass differentially and produce equal amplitude of vibrations in the spot of light. This can be noted and adjustment of the extent of swing of the spot on the screen be made with each current separately.

The suggestion may here be made that, having constructed as perfect a machine for generating alternating currents as possible, one in which the spacing of the waves during a revolution is exact and the amplitudes of such waves the same throughout a revolution, and the form of the wave that which may be considered best in practice, it would be easily possible by coupling another machine to the first so as to rotate in perfect harmony therewith, to note the divergences of form of amplitude and position of waves in the two machines.

If the screen be replaced by a sensitive revolving plate which is geared to give exactly the same speed as that of the machines when the machines are absolutely and perfectly matched, the spot should remain stationary and describe a circle on the plate around the centre of motion of the plate; but if the plate shows departures from this circular form not only is a lack of harmony between the two waves or structures declared, but the positions of the departures from harmony are pointed out by the positions of divergence from a circular path on the plate.

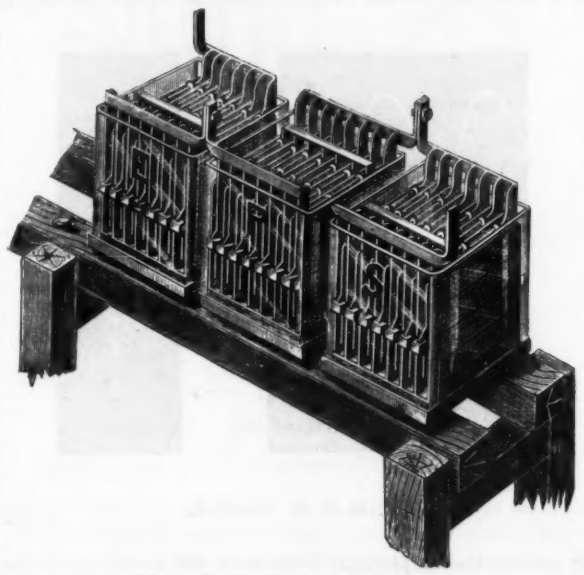
Whenever the wave produced by one machine is out of harmony, either in position of amplitude or shape with that of the other, the divergences will be indicated by the image on the plate showing a corresponding departure from a circle. The relative motions of the plate and machines being alike, the defects can at once be traced to their source. The movement of the spot upon the revolving plate in the case just referred to should, of course, be towards and from the centre of motion of the revolving plate.

Likewise with such an apparatus having a revolving plate the current of a machine will, if the plate revolve with the armature, trace a wavy line returning into itself at every revolution, and it will be a record of the alternations or waves produced in every part of a revolution of the dynamo armature.

It will be evident that the curves obtained will only represent the true waves of current when the movement of the diaphragm is proportional, or nearly so, to the current in the coil around the core *I*. The current at any time will produce magnetism in the core substantially proportional to the current at any instant, which magnetism induces opposite magnetism in the diaphragm; and the pull on the diaphragm would be nearly as the square of the current at any instant when the magnetism induced is far below saturation, so-called. The magnetic pull on the diaphragm is opposed by the elastic force of the same acting as a sort of compound spring against the pull upon it.

The nature of the effects will also vary somewhat with the distance from the diaphragm at which the core *I* may have been placed. Whether it will be possible to adjust all variations so that the movement of the spot of light may be in exact proportion to the current whereby the true waves may be obtained, is not known.

It is to be understood that, in the use of such apparatus



NEW E. P. S. ACCUMULATOR.

as has been described, the effects of the resistance and self induction of the coils *C* traversed by the waves of current should be so small as to have no considerable effect on the currents to insure even moderate accuracy in the indications obtained.

Improved E. P. S. Accumulator.

In order to avoid some of the difficulties met with in practice, the new type of storage cell which will be issued in future by the Electrical Power Storage Company, of London, has been considerably improved in its mechanical detail and arrangement. The containing vessels are larger, in order to allow an increase of distance between the opposite plates. This distance is now sufficient to prevent a falling pellet of paste from bridging the gap between the plates. The spongy-lead electrodes are burned together in five places, viz, at the bottom corners (constituting feet on which the section stands), about midway on either side of the plates, and again at the conducting strip. At the bottom corners a projection is made on the plate which has the effect of raising it, so that there is a space of about 1¼ in. clear between the bottom edge of the plate and the bottom of the contained vessel, and, as a result, the powder which may fall cannot deleteriously effect the working of the battery. The peroxide plates are burned together in two places at the conducting strip, and at a carrier strip on the top edge of the plates. They are supported clear of the bottom of the contained cell on insulating saddles, which are carried by the bar which connects the porous lead plates at the side.

The separating arrangement consists of vertical ebonite forks of rectangular section, which give greater rigidity than has heretofore been obtained. There are no glass plates and no india rubber bands or plugs, the idea being to dispense with any material which can be considered of a perishable nature (the peroxide plates, of course, excepted). It is believed that as a result of these improvements the battery will be able to work uninterruptedly without attention for at least two years, and that when it requires cleaning after that period the labor involved will not exceed a quarter of an hour for a cell having a capacity of 600 or 700 ampère hours.

An Electric Arc Pinwheel.

BY C. G. Y.

The note made by Mr. G. W. Blodgett in THE ELECTRICAL WORLD of Jan. 21, on "An Incandescent Lamp Freak," was intersting to me in showing that others had also noticed a curious, though not necessarily weak, point in lamps known as "series incandescents."

It is possible that Mr. Blodgett's theory concerning that particular lamp is correct, and if so it indicates a weak point, perhaps in the shape of bulb used, or imperfect glass.

Some of the small types of Schuyler series lamps, when in the first experimental stages, produced very peculiar examples of weakening and *blowing in* of glass.

Owing to the shape of bulb used, it generally occurred at the top of the glass, being nearest the filament at that point. The action coincided with Mr. Blodgett's views, the glass melting before the filament was destroyed. By using a larger and better proportion of bulb, that trouble was removed, however, and with the new shape it would require an actual break and arcing of the filament to melt the glass.

In testing some of the first fusible cut-outs used in the Schuyler series lamp, a great many lamps were put on the arc circuit, small holes being broken in the tip end. It is unnecessary to say there were almost as many different forms produced by the *blowing in* as there were lamps used.

The most peculiar *freak* ever experienced was what might be called an "electric pinwheel." A 75 c. p. series lamp was put on a 9 ampère current, tip end downwards, but the tip broken off, leaving a hole in the bulb about $\frac{1}{16}$ inch in diameter. The lamp burned for fully one minute without any signs of fracture, then the candle power began to rise rapidly until it rivaled an arc in brilliancy and the filament broke on one side near the mounting, leaving it suspended by one leg on a No. 22 annealed copper wire. For some unexplained reason the filament began to revolve, carrying the electric arc from its free end, and every time it approached the air hole in the bulb a sudden rush of air would occur, probably on account of the heat; this gave it sufficient force to cause its rapid rotation, which lasted for about 5 or 10 seconds.

I do not claim this theory as correct, but it seems probably correct. At any rate, there was virtually an electric arc pinwheel within an incandescent lamp, and it impressed me as a queer freak, an instance of interesting common-place "freaks" met with in even the highest scientific researches.

A Renewal of the Storage Car Challenge.

To the Editor of The Electrical World:

SIR: In accordance with his habit of "making mountains out of mole hills" (*vide*, that curious street railway with Alpine grades which he has discovered in the upper part of New York city, and was so muddy and so very steep when he ran his car over it), Mr. Mailloux says in your issue of this date, that he cannot accept my invitation to bring his car to Philadelphia at my expense and run it against our Reckenzaun car, because the gauge of our track is wider than the gauge of his car. He was "greatly amused" at my offer, because, he says, I knew he could not accept it, for the above insurmountable reason. (I must confess I did think he might possibly *make it an excuse.*) However, I offer him another chance to be *amused*, although I mean business. I now renew my offer, with the addition that I will change the wheels of his car to suit our track, or will change our track to suit his car, *as he may choose*, at my expense. Our car to be equipped with Electrical Accumulator Co.'s cells and Reckenzaun motors, as heretofore; and his can be equipped with his Julien cells and motors, as heretofore; each car to have the same weight of cells, and the same weight of car and load carried exclusive of cells and motors. I still fear I may not have the pleasure of his acceptance, as I think *he doesn't want to come*, but will find another excuse.

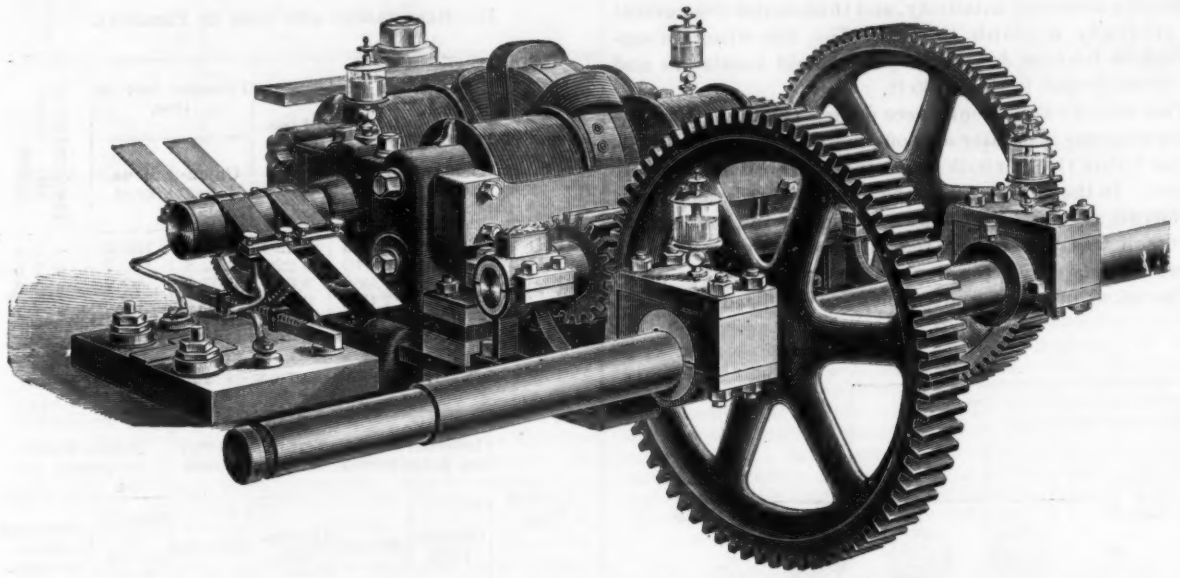
PHILADELPHIA, Jan. 21. WM. WHARTON, JR.

An Electric Accident Preventor.—A most wonderful invention is reported in Vienna. An Austrian engineer has, it is said, designed a truck to run before every railway train, being maintained always at a fixed (but adjustable) distance in front by the force of an electric current transmitted along the rails from a dynamo on the engine. The current is conducted through mercury contained in glass tubes on the pilot-truck. If, therefore, the truck comes into collision the tubes are broken and the contact consequently destroyed. The interruption of the current instantly and automatically applies the brakes on the following train. It is claimed by the inventor that two expresses fitted with this system might with impunity be set to run full tilt at each other. The collision of their pilot trucks would arrest the progress of both trains before they could meet. The element of human fallibility is accordingly entirely eliminated, and drivers may dash through a whole series of danger signals without risk, being automatically arrested the moment they reach the spot that is really dangerous.—*St. James' Gazette.*

Brush Electric Motors.

We have already referred to and described in our columns the various stationary motors built by the Brush Electric Co., Cleveland. These machines are self-regulating, and adjust themselves to all loads, maintaining constant speed. The regulation is effected by the shifting of the commutator upon the shaft, which alters the line of commutation in a corresponding manner.

The company have also designed a gearing attachment for street railway service, which is shown in the accompanying engraving. Here, it will be noted, the motor is pivoted upon the axle, which carries one pair of wheels,

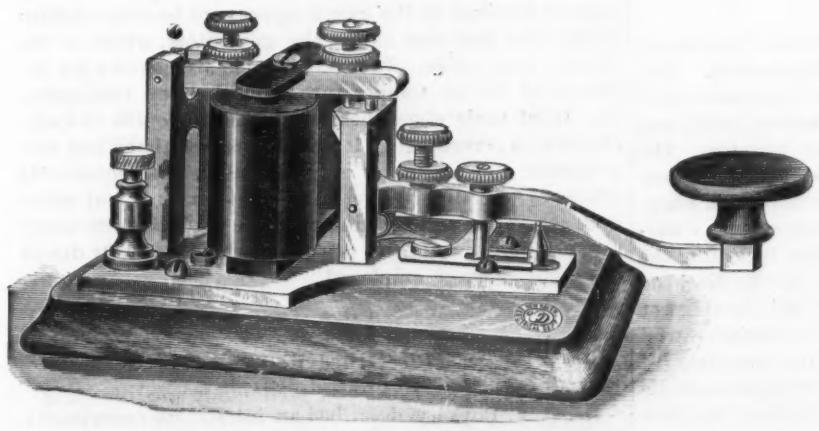


THE BRUSH MOTOR ON AN ELECTRIC CAR.

and a large gear wheel upon the axle is driven by the motor through a pair of reducing gears, one of which meshes with the driving wheel itself, and the other with the gear wheel on the shaft of the motor. The motor, being always central with the shaft, vibrations have no effect on the smoothness of running, and all strain is removed from the gear wheels. To vary the speed of the motor it will be seen that the brush holder is in the form of a toothed sector which gears with a rack under the control of the driver. By shifting the rack backward or forward the position of the brushes upon the commutator is correspondingly varied, and with it the speed.

The Electrical Distribution of Time.

Many attempts have been made in past years to solve the problem of causing the pendulums of different clocks to vibrate in unison with each other by means of an electrical current periodically transmitted from a station, but hitherto inventors have not succeeded in obtaining perfect synchronism. In a paper recently read before the Paris Académie des Sciences, M. Cornu has returned to the subject and shown analytically that to obtain synchronism in a vibrating system, the necessary and sufficient condition is that the free motion of the system shall be a damped vibration, and has also pointed out that the stable condition is obtained more rapidly the greater the amount of the damping. To carry this out in practice, it



COMBINATION TELEGRAPH SET.

is necessary, if two pendulums are to vibrate synchronously, that they should experience an impulse in one direction and a retardation in the opposite sense in rigorously the same way. This M. Cornu obtains by fixing a permanent magnet to the lower extremity of the pendulum, the magnetic axis being perpendicular to the axis of the pendulum. An electro-magnet with an open circuit is fixed on one side of the pendulum and attracts it at each oscillation. On the other side is placed another electro magnet, with a closed circuit, which acts simply as a damper and checks each swing. In this way perfect synchronism can be obtained between clocks a very considerable distance apart, which, indeed, is only limited by the length of line at which the retardation of the current from self-induction becomes sensible. Clocks constructed on this principle for the Geographical Department of the French War Office have been successfully synchronized over a distance of forty miles of a defective telegraph line.

The "Unique" Combination Telegraph Set.

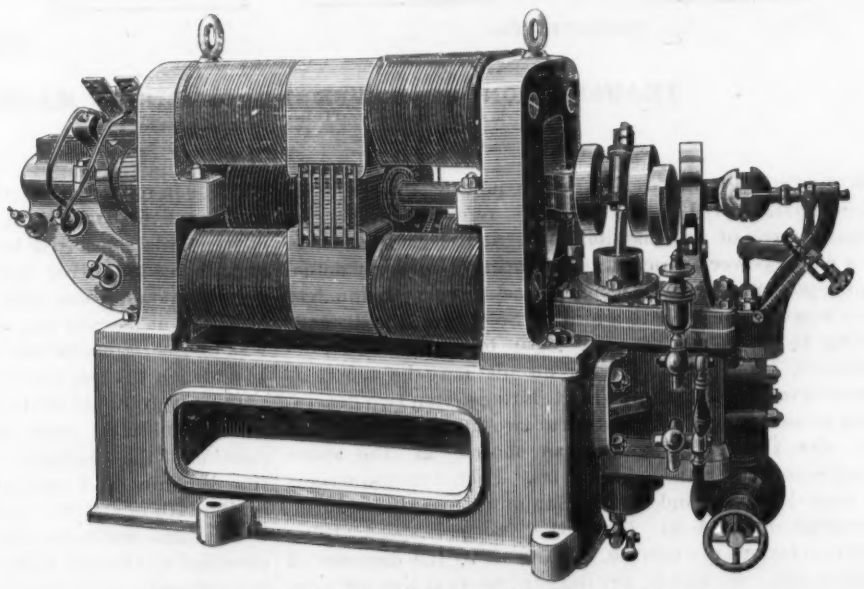
Our illustration represents the "Unique Combination Set," including key and sounder, recently brought out by the New Haven Clock Company, of this city, and designed as a short line instrument and for learners' use. Although designed as an instrument of moderate cost, the fittings are entirely of brass, no iron entering into the construction whatever, and the lever is nickel plated. As will be seen, both the key lever and the hammer of the sounder are pivoted in solid bearings, which prevent all lateral motion, and the vertical motion is regulated by the usual tension screws and springs. In this instrument also an improved switch is employed for cutting in and out. This consists of a slotted piece which, when slid forward, presses upon the seat of the anvil under the key lever, and thus makes a good rubbing contact. The instrument, mounted first on a brass bed-plate, is securely fixed to a wooden base, and presents a very neat and compact appearance. The same style of construction is employed in the manufacture of keys and sounders separately, and all parts being made by machinery and to gauge, accurate work is insured.

High Speed Trunk Engine and Victoria Dynamo.

The compact form of trunk engine with dynamo combined, illustrated in the accompanying engraving, was designed by Mr. J. S. Raworth, the superintending engineer of the Anglo-American Brush Electric Light Corporation of London, as an arrangement where space is so limited as to allow but bare room for a dynamo alone. The combined plant was exhibited at work at the Royal Jubilee Exhibition at Manchester, where it was acting as a generator to an electric motor of the same type of dynamo.

In the construction of this small high-speed engine many points have been very carefully considered to render it steady, noiseless and durable. The general type of the engine is shown in the illustration, for which we are indebted to the London *Electrical Review*, and it will be noticed that it is of the "trunk" pattern as regards its piston, the trunk being formed of a hardened steel tube ground perfectly true, and fitted at its centre with the piston which works in a cylinder. Both sides of this trunk are carried through a gland fitted with a metallic packing of a special construction, which makes it self-adjusting, and the lower end of the trunk projects through this gland into a closed chamber, which is drained to remove water. Inside this trunk is the connecting-rod pin, which is also of hardened steel, and can be removed. The other end of the connecting rod takes on to the crank pin, and is fitted with brasses having a large wearing surface. The crank is of steel, forming also the spindle of the dynamo webs. After being slotted and finished, the crank is fitted with iron counter-balances of a shape such that, when in place, each crank cheek becomes a disc, and wrought iron hoops bored and shrunk on and afterwards turned and polished secure their counter-balances.

The very high speed, 900 to 1,000 revolutions, at which this double-acting reciprocating engine works necessitates most accurate balancing of the rotating parts, and perfect cushioning of the reciprocating parts, all of which are made as light as possible to assist this end. The eccentric which actuates the piston valve is also balanced and finally adjusted by experiment. The piston valve itself is very light and accurately ground into the liner forming its working seat.



TRUNK ENGINE AND VICTORIA DYNAMO.

Volk's Electric Dog-Cart.

Mr. Volk, whose electric railway is known to all visitors to Brighton, Eng., has constructed an electrically driven dog-cart, which attracts a good deal of attention among the leisured crowds which throng the gay Sussex watering-place. It is driven by a half horse-power Immisch motor and 16 small E. P. S. accumulators, which have a capacity equal to six hours' work. In the desire to keep the machinery light scarcely sufficient power has been provided, so that, although the vehicle will make a speed of nine miles an hour on asphalt, it only makes a speed of four miles on a soft macadam road, while, with two passengers, an incline of 1 in 30 is the limit of its climbing power. The motor runs at a high speed and transmits its motion by means of a Reynolds chain to a countershaft, from which another chain carries the power to a 4-foot wheel attached to one of the road wheels. This last driving wheel is formed of a series of blocks about 1 foot apart.

Lighting a New York Ball-Room by Accumulators.

To the Editor of The Electrical World:

SIR: It may be a matter of interest to you to learn that the ball-room of Mr. Ogden Mills' residence, Sixty ninth street and Fifth avenue, was lighted by means of the N. Y. Isolated Accumulator Company's storage batteries on Monday night, 16th inst. The occasion was a ball and house warming, and a large number of the leading members of New York society were present. The ball-room was brilliantly illuminated by sixty 16-candle-power lamps. The current was supplied from the batteries which had been charged on the previous Friday at the Electrical Accumulator Company's factory, Newark, N. J., carted to Mr. Mills' residence on Saturday, placed in position in the cellar and connected with the lamps on Monday, and used from 9:30 P. M. until 3:30 A. M. the following morning without a single interruption of any kind.

The effect of the lights was very beautiful, and many expressions of admiration were heard on all sides. Mr. Cornelius Vanderbilt has since ordered sufficient storage batteries to illuminate his Fifth avenue mansion on the occasion of his grand ball to be given on the 23d inst.

This is the first instance in which storage batteries have thus been used in America to furnish temporary light for special social occasions, and its success is likely to lead to a large business of this character in all prominent cities.

E. A. LESLIE,
General Manager.

NEW YORK, Jan. 18.

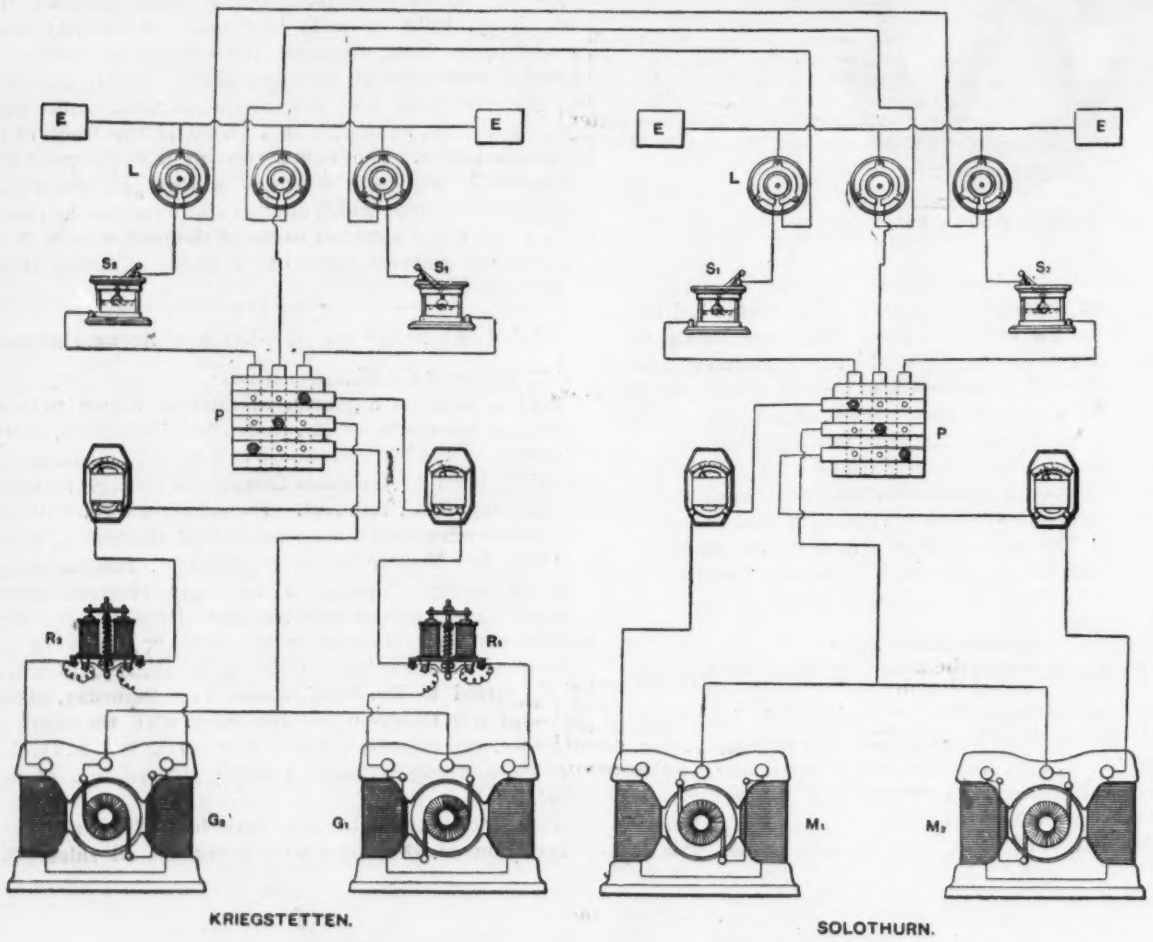
Minnesota.—A decision was recently rendered by the Supreme Court of Minnesota, holding that the erection and maintenance of telephone poles and wires, the fee of which is in the adjacent proprietor, is an infringement of such proprietor's rights, although the city authorities may have consented to this use of the street.

Electric Transmission of Energy by Oerlikon Machines.

Our columns have already contained an account of experiments made at Zurich, Switzerland, with Oerlikon dynamos, designed to transmit the power of a waterfall a distance of five miles from Kriegstetten to Solothurn. These experiments were made by a committee of engineers and scientific men, with a view to ascertain the total commercial efficiency of the transmission plant; but as the machines were in this case placed side by side, the results could only be taken as approximately correct. It is evident that, in such an arrangement of machines and resistances erected within the limits of a covered workshop, the insulation of the circuits presents no difficulty whatever, whereas in the actual installation, when many miles of overhead wires must be used, the insulation becomes a matter of some difficulty, and atmospheric influences may also have some effect upon the performance of the plant. These considerations induced the makers to arrange for some further trials with the plant as actually installed. A committee was appointed, under the presidency of Professor Amsler, of Schaffhausen, the well known inventor of the planimeter, and other well-known gentlemen were members, among them Prof. Weber, of the Zurich Polytechnic School. This committee have just issued their official report on the trials made on the 11th and 12th of October last with the plant as actually installed. Before quoting the results of these trials, it will be well to briefly refer to the general arrangement of this installation. At Kriegstetten there is a water power available, representing about forty actual horse-power, and the problem was to carry as much of this power as possible to a mill in Solothurn, the distance being 4¼ miles as the crow flies; but, allowing for deviations, the length of each circuit may be taken as about five miles. There are at Kriegstetten two generating dynamos, and at Solothurn two motors, coupled up on the three-wire system, as shown in the above illustration taken from *Industries*. Each dynamo weighs 3 tons 12 cwt., and has a Gramme armature 20 in. diameter and 14 in. long, the normal speed being 700 revolutions per minute. Referring to the diagram of connections, G_1 and G_2 are the generators at Kriegstetten, and M_1 and M_2 are the motors at Solothurn. R_1 and R^2 are electro-magnetic switches which automatically come into action and short circuit the exciting coils in case of the current rising beyond a certain limit. This provision was introduced in order to guard against the destruction of the generator in case a short circuit should take place somewhere in the line. The current from each of the generators passes through an ammeter and then to a plug switch-board P, to which is also connected the balancing wire joining the negative brush of G_2 with the positive brush of G_1. The balancing wire is then carried direct to the middle one of the three lightning arresters L, and then to the middle wire of the line, while each of the outside wires is led through a liquid switch $S_1 S_2$, then to a lightning arrester, and to the line. Each lightning arrester consists of a circular metal disc, the edge of which is provided with projecting teeth, and situated in a concentric metal ring, the internal circumference of which is also provided with teeth, but not touching the teeth of the disc. All the discs are connected with a common earth wire and two earth plates E E. The same provision against lightning is made at the motor station. The switches S_1 S_2 are of peculiar construction, and consist of a vessel containing a conducting liquid and a perforated metal ball dipping into it. When the current is to be switched off, the handle is turned so as to raise the ball out of the liquid; but the circuit is not immediately interrupted, since the liquid within the balls issues in fine streams out of the perforations, and so maintains the connection for a short time after switching off. As the liquid in the ball gets exhausted, and the streams become thinner, the resistance of the liquid connection is gradually increased to infinity, and thus causes the current to gradually diminish to zero. The line wires are supported on Johnson & Phillips' patent fluid insulators and the average span is about 130 ft,

Two sets of experiments were made. On the 11th of October only one generator and one motor were tested, while on the 12th of October both generators and both motors were tested. In the latter test the balancing wire was cut out of circuit as of no importance when, as in these experiments, it was quite easy to regulate the load of each motor so as to fairly divide the work between them.

Electrical measuring instruments were fitted up at both stations in rooms sufficiently distant from the machinery so as not to be influenced by stray magnetism. The current was measured by large tangent galvanometers, and Thomson mirror galvanometers, standard cells, and potentiometers were used to measure the pressure. The object in measuring the current at both ends of the line was to ascertain whether any appreciable leak took place. In addition to these purely electrical measurements, observations were made at the generator station regarding the water level in the head and tail race of the turbine, the position of the regulator on the latter, and the speed of the dynamos and turbine. After the transmission trial on the 11th of October was completed, the armature of the dynamo was taken out and replaced by a plain spindle provided at the end with a brake. The turbine was then started again under exactly the same conditions as were noted at the previous trial, and the power absorbed by the brake was measured. The comparison between the power thus measured and the electrical energy given out by the generator is evidently the commercial efficiency of the latter. On the following day both generators and both motors were tested in the same condition as prevails in actual practice, with the only exception that, as already mentioned, the balancing wire was cut out of circuit. This alteration, which could obviously not increase the efficiency of the whole system, was made to simplify the measurements. The power absorbed by the generators was computed on the basis of the previous day's trial from the observed conditions under which the turbine worked, while the power developed by the motors was on both days directly ascertained by means of a friction brake fitted to a first motion shaft common to both motors. A small correction was made for the power absorbed by this shaft when running idle. The following tables give the results as published by the committee:



TRANSMISSION OF POWER BY OERLIKON MACHINES.

I.—ELECTRICAL MEASUREMENTS.

Time of trial.	Electromotive force.		Terminal pressure.		Current measured at	
	Generators.	Motors.	Generators.	Motors.	Generators.	Motors.
11th Oct.	1231.6	988.6	1177.7	1041.2	14.20	14.17
" "	1237 0	1016.8	1186.8	1066.1	13.24	13 28
12th "	1836.5	1575.4	1753.3	1656.1	11.48	11.42
" "	2129.0	1896.2	2058.0	1965.1	9.78	9.79

II.—RESISTANCES AND LOSS OF PRESSURE.

Time of trial.	Resistance of machines.		Line resistance.	Pressure lost in line.		Temperature of air. Centigrade.
	Generators.	Motors.		Calculated.	Measured.	
11th Oct.	3.741	3.716	9.228	130.9	136.5	+ 7.5
" "	3.741	3.710	9 228	122.3	120.7	+ 7.5
12th "	7.251	7.060	9.044	103.7	97.2	+ 3.2
" "	7.240	7.042	9.040	88.4	92.8	+ 3.2

III.—DETERMINATION OF ENERGY.

Time of trial.	Internal electrical horse-power.		Terminal electrical horse-power.		Actual horse-power.	
	Generators.	Motors.	Generators.	Motors.	Supplied to generators.	Obtained from motors.
11th Oct.	23 76	19.03	22.72	20.02	26.15	17.85
" "	22.27	18.34	21.35	19.23	24.54	16 74
12th "	28.64	24.46	27.34	25.71	30.87	23.21
" "	28.29	25.21	27.37	26.13	30.87	23.05

IV.—PERCENTAGE OF EFFICIENCIES.

Time of trial.	Electrical efficiency.		Commerciel efficiency.		Total efficiency of transmission.	Remarks.
	Generators.	Motors.	Generators.	Motors.		
11th Oct.	90.7	93.7	86.8	89.1	68.3	One generator and one motor.
" "	90.6	91.3	86.9	87.1	68.2	
12th "	92.8	94.8	88.5	90.3	75.2	Both generators and both motors.
" "	91.6	91.4	88.7	88.2	74.6	

An inspection of these figures will show that there is practically no loss of current by leakage on the line. In some cases the current measured at the motor station is slightly below that measured at the generator station; but the discrepancy is exceedingly small, and evidently due to personal or instrument errors, since in some other cases the current received by the motors appears to be even slightly larger than that sent out by the generators, which is obviously impossible. The second table also shows the influence of the air temperature upon the total resistance. The third table gives the power, and the fourth the efficiencies in percentages. It will be noticed that when one generator and one motor only were used, the commercial efficiency was slightly over sixty-eight per cent.; but when both generators and both motors were used, this efficiency rose to about seventy-five per cent., which is clearly due to the higher voltage employed.

Electrified Balsam.

Mr. C. V. Boys has described an interesting experiment he has made with some electrified gums and balsams. If sealing-wax or any such sticky material is melted in a cup and put on the conductor of an electrical machine, it throws out threads and fibres which break into beads. The cup containing the gum should be inclined from the operator and the electrical machine before the latter is worked, else both will be covered by an invisible sticky web. Burnt india-rubber also sent out the filament; but Canada balsam appears to show the phenomenon best. When a candle flame is held near a cup throwing out such filaments, they shoot to the flame, and sometimes cover the candle, and sometimes discharge into the flame and turn back into the cup. In a few minutes a large quantity of these sticky threads can be made, and as they break into beads, Mr. Boys points out that this plan can be used to pulverize these substances, which are not easily pulverized in the ordinary way.

Portable Voltmeters for Measuring Alternating Potential Differences.*

BY W. E. AYRTON AND JOHN PERRY.

It is now well understood that a high-resistance electrodynamometer cannot generally be used for measuring alternating potential differences, in consequence of the self-induction of the dynamometer causing the effective resistance—and therefore the sensibility—of the dynamometer to vary with the speed of alternation. Further, even for the measurement of direct potential differences an ordinary high-resistance voltmeter, employing the magnetic property of the current, is not entirely satisfactory if the forces employed be large (as they generally have to be in dead-beat portable instruments), since, in that case, the current, if kept continuously on, slowly heats the voltmeter, and by increasing its resistance causes its sensibility to diminish. It has, therefore, for some time seemed clear that the heating effect of a current should be used for voltmeters.

Captain Cardew was the first person to utilize this principle in the construction of voltmeters, and, as far as we are aware, is the only person who, up to the present time, has employed the extension of a wire caused by the heating produced by the passage of a current to measure the potential difference at its terminals. His instruments are well known, and have afforded most valuable aid in the measurement of alternating potential differences; and we, in common with other electrical engineers, owe him a debt of gratitude for providing us with the only commercial instrument that has existed for the measurement of alternating potential differences.

In "Practical Electricity" an attempt has been made to impartially sum up the advantages and disadvantages of all the more important ammeters and voltmeters, and we cannot do better than repeat what was there said about the Cardew voltmeter, especially as we understand that Captain Cardew considers the criticism to be a fair one.

"CARDEW VOLTMETER.

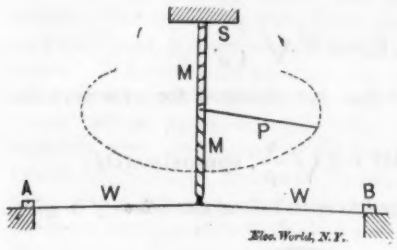
"*Advantages.*—First, it has but a small heating error; second, the self-induction is negligible. It is also dead beat, direct-reading, not disturbed by magnets, and fairly portable, although large.

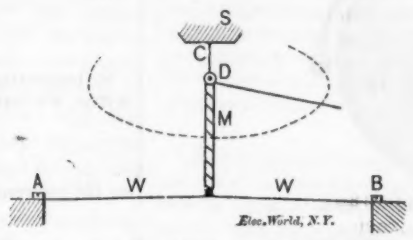
"*Disadvantages.*—It absorbs a good deal of energy; second; it cannot be used for measuring a small potential difference, for we cannot make it of thicker wire, as we should do in the case of an ordinary voltmeter intended to measure small potential differences, as this would render it sluggish, since a thick wire traversed by a current heats and cools slowly on starting and stopping the current; third, there is considerable vagueness in the readings near the zero point, and sometimes inaccuracy in the upper parts of the scale."

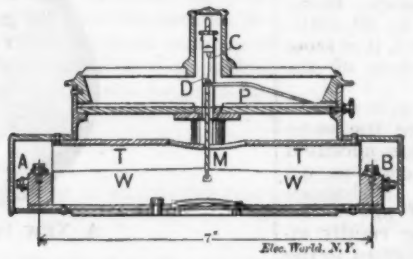
Toward the end of 1885 we were engaged on certain experiments on the governing of transformers in series to give a constant potential difference at each house, and, as our experiments were to be conducted with small transformers, we required a voltmeter which would measure an alternating potential difference of three or four volts with accuracy. Such an instrument not being in the market, we were compelled to devise one, and we were led to consider whether the Cardew principle might not be employed in an instrument which should give quite definite readings even near the zero, and produce a large deflection when an alternating potential difference of a few volts was maintained between its terminals.

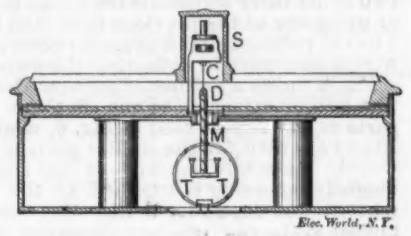
Part of the vagueness in the readings of the Cardew instrument we saw was due to the employment of toothed wheels; and, as explained in a paper† read by us before the Royal Society in 1884, toothed wheels have not recommended themselves to us as a means of magnification in ammeters and voltmeters, in consequence of the friction they are liable to introduce. In fact, after giving toothed gearing an extensive trial in our instruments, originally described to this society‡ in 1882, we decided to abandon its use in 1884.

If a voltmeter depending for its action on the expansion of a wire by heating is to be sharp in its action, the wire must be fine; and if it is to measure a small potential difference the wire must be short; hence we were led to consider whether it was not possible to construct a voltmeter of quite a short length of fine wire, and observe its extension with some frictionless magnifying arrangement. This led us to consider the platinum wire telephone described by Mr. Preece in his paper* read before the Royal Society in 1880, which, although composed of but a short length of wire, evidenced by the motion of the diaphragm, to the centre of which one end of the wire was attached, every change in the current passing through it. After thinking out various means of attaining this result, we were led to see that one of our magnifying springs, described to this society in 1882, furnished the means of obtaining a sufficiently sensitive frictionless magnifying arrangement. For experiment shows that if a short piece of fine wire *WW*, Fig. 1, only seven inches long be stretched between two supports *A* and *B*, to which it is *rigidly* attached, and if it be pulled slightly out of the straight line by one of our right and left handed magnifying springs *M*, *rigidly* attached at its one end to the wire and at the other to a support *S*, the axes of the spring and the wire being at right angles to one another, the arrangement is so delicate that the expansion produced by even the approach of a warm hand is evidenced by the rotation of a pointer *P* attached to the centre of the right and left-handed magnifying spring. The absence of all gearing and the rigid fastening of both ends of the spring, combined with the fineness of the wire, make the arrangement remarkably dead-beat in its action; and when the wire is inclosed in a short metal tube we have a voltmeter which will measure even the fraction of a volt, whether the potential difference be direct or alternating, since the readings even near the zero are quite definite.









FIGS. 1, 2, 3 AND 4.—AYRTON AND PERRY PORTABLE VOLTMETERS.

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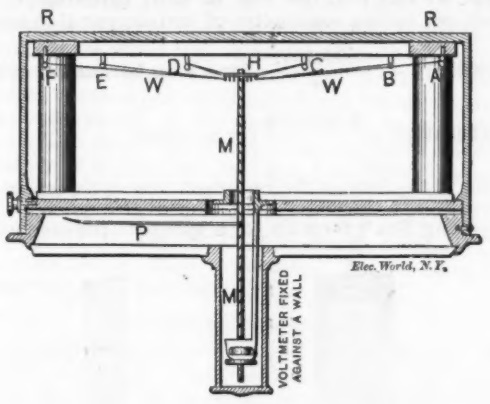


FIG. 6.

The right and left-handed spring was employed to avoid any twist being given to the wire; but one of our assistants, Mr. Bourne, who has worked at this instrument with his customary ingenuity and dexterity, soon found out that half the length of the spring could be dispensed with, and an equally efficient but much more compact arrangement could be effected by using a single ordinary magnifying spring *M*, Fig. 2, and introducing a small piece of fine wire *C D* between the one end of the spring and the stretched wire *W W*, or between the other end of the spring and the support *S*.

To get extreme quickness of action on changing the potential difference, it is desirable to employ a thin wire; and as the strength of such a wire is small, the next step was to combine a number of wires mechanically in parallel, and electrically in series or parallel, the wires being attached at their middles to a stirrup which is carried by the magnifying spring; and voltmeters containing as many as twelve short wires, each about seven inches long, were made in the early part of the summer of 1886.

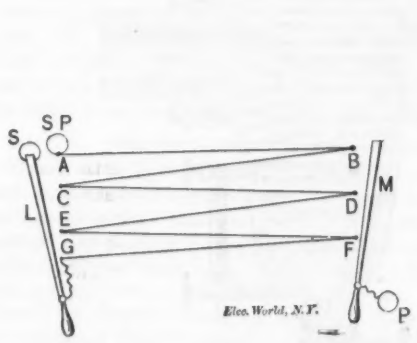
These instruments showed, however, the sluggishness which is familiar to the users of the Cardew voltmeter, and we had to set ourselves to investigate it. Stationary metallic screens were inserted between the wires to assist the cooling, and various other means tried, without success, when we set Mr. Bourne to investigate the general question of sluggishness. A variety of experiments were made by him on the rate of variation of the permanent state of a wire with the variation of potential difference at its terminals, as affected by varying the proximity of the wires, their length, etc. This occupied him several weeks, and the experiments he made were too numerous to be recorded here. With our many-wire voltmeter the sluggishness was certainly not due to mechanical friction, as our magnifying spring is practically frictionless; and we gradually saw that the peculiar creeping back in the deflection of a Cardew voltmeter, when a perfectly constant potential difference was first set up between the terminals, was due to the fact that the draught of air created in the tube by the heated wires takes an appreciable time to be produced, so that the wires are hotter directly the potential difference is applied than they become when the draught begins to flow. A number of more or less successful devices were tried for overcoming this defect—for instance, even the employment of a draught independently maintained—when we found in the summer of last year that the simple device of placing the tube horizontal instead of vertical, and using very fine wire—not much exceeding one-thousandth of an inch in thickness—overcame all the difficulty. The importance of placing the tube horizontal was also subsequently seen by Mr. G. S. Ram this year, and consequently the scale of the Cardew voltmeters are now marked so that the zero is at the top when the tube is placed horizontal.

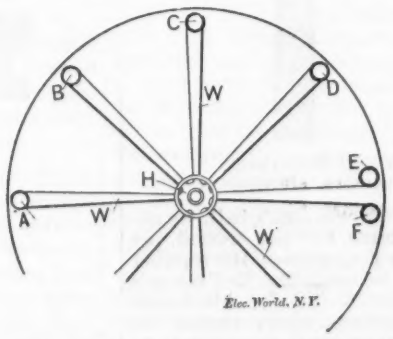
This home-made instrument with two wires (lying on the table) was then completed in August of last year, and was found to be remarkably sharp and decisive in its action, giving a deflection of 300 degrees with 14.22 volts maintained at its terminals. Even a fraction of a volt can be measured with it, as the readings are quite definite even near the zero.

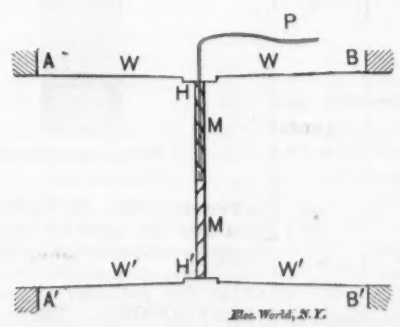
The finest wire employed by Captain Cardew in his commercial instrument has a diameter of 0.0025 of an inch, but in consequence of our magnifying gearing being frictionless and comparatively massless, we are able to use much finer wire—not more than 0.0014 of an inch in diameter—without any fear of injury, even if the instrument receive a sharp knock. This greater fineness of the wire gives us three times as much resistance per foot, and therefore enables the instrument to be very much smaller; also, as the ratio of surface to sectional area is far greater, the heating and cooling is far more rapid; that is, the instrument is much more dead-beat.

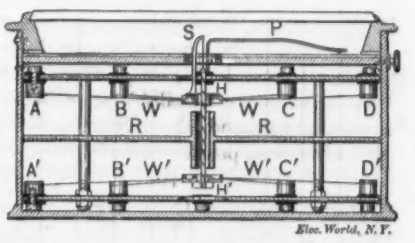
Figs. 3 and 4 show two sections at right angles to one another through the centre of another two-wire voltmeter. It has been constructed on the lines of the original one, but in a more workmanlike manner. It is direct-reading, and measures from 0 to 10 volts, the deflection for that potential difference being some 250 degrees. The same letters are employed to designate the various parts of the instrument as were used in Figs. 1 and 2, with the addition of *T*, the metal tube surrounding the wires; and the stirrup connecting the end of the magnifying spring with the wires is also shown.

The employment of several short parallel wires soon suggested the addition of the commutator described in our paper read before this society in 1881, for varying the sensibility of a voltmeter. But whereas our commutator ammeters and voltmeters in which the magnetic action of a current in deflecting a magnetized needle was employed the current had to flow through every wire in the same direction, whether the wires were joined in series or in parallel, with this new form of voltmeter, in which the heating property is employed, it is unimportant which way the current passes through a wire. Hence the pins in the barrel of our old commutator which gave trouble may be entirely dispensed with, and the commutator assumes a very simple form. In fact, if *A B*, *B C*, *C D*, *D E*, *F G*, Fig. 5, represent wires joined in series in the new form of voltmeter, the series connections need not be disturbed when a parallel arrangement is required, since all that need be done to join them in parallel is to connect the points *A*, *C*, *E*, *G*, by means of the bar *L*, and *B*, *D*, *F*, by means of the bar *M*. *S* and *S P* are the terminals for series and *P* and *S P* for parallel, so that if the commutator be accidentally turned from series to parallel the circuit is broken and the wires are not fused. This instrument lying on the table is a four-wire voltmeter, and the sensibility is such that 15.2 volts gives a deflection of 39 degrees when the commutator is turned to series, and 295 degrees when it is turned to parallel.









FIGS. 5, 7, 8 AND 9.—AYRTON AND PERRY PORTABLE VOLTMETERS.

It is important to notice that the employment of this commutating device to vary the sensibility enables all the wire in the instrument to be always operative in deflecting the pointer; whereas, if the ordinary device of adding an outside resistance coil be employed to enable the voltmeter to measure a larger number of volts, the energy spent in heating this outside resistance coil is entirely wasted as far as deflecting the pointer is concerned; in fact, the greater the outside resistance, the more inefficient becomes the voltmeter.

For the object of still more completely carrying out the principle of employing a number of short wires we have also made voltmeters in the following way: The wires are arranged like the spokes of a small bicycle wheel *W W*, Fig. 6; that is, we have a circular rim of a wheel *R*, which

* A paper read before the Society of Telegraph Engineers and Electricians.

† "A New Form of Spring for Electric and other Measuring Instruments."

‡ "Measuring Instruments used in Electric Lighting and Transmission of Power."

* "Thermal Effects of Electric Currents."

may be of the same metal of which the wires are made, to eliminate errors due to change of temperature, fitted with non-conducting studs *A*, *B*, *C*, *D*, etc., to which the wires are attached. There is also a small non-conducting central piece *H* corresponding with the hub of a wheel, to which the wires are also attached; and as the wires come from rim to middle backward and forward several times, the arrangement appears like a bicycle wheel with many spokes, as seen in Fig. 7. One end of a right and left-handed magnifying spring *M*, Fig. 6, under tension, is rigidly attached to the hub *H*, and its other end to the support *S*. Hence, as the wires expand on heating, the spring draws the hub *H* more out of the plane of the rim, and the rotation of the pointer *P* measures the current. *R* is a metallic plate put between the two bicycle wheels to assist in the cooling. This instrument on the table is made exactly in this way. Using two of its three terminals the range is from 0 to 50 volts; or using one of the previous ones and the third, it is from 0 to 100 volts. In both cases, however, the whole of the wire is operative in deflecting the pointer.

Fig. 8 shows a voltmeter made with two bicycle wheels. The letters attached to one of them refer to the same parts as the letters used in Fig. 6, while similar accented letters are used for the similar parts of the second bicycle wheel. As before, one end of the right and left-handed magnifying spring is attached to the hub of one of the wheels, but instead of the other end being rigidly attached to the case of the instrument it is attached to the hub of the other wheel. Hence the rotation of the pointer is produced by the expansion of all the wires on both wheels. Fig. 9 shows the actual arrangement of the double bicycle-wheel voltmeter where an ordinary (not a right and left-handed) magnifying spring

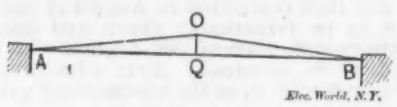


FIG. 10.

M is employed, with a flexible connection of fine wire carried by the support *S*, which itself is carried by the hub *H* of one of the wheels. The wires are electrically divided into four sets. When the commutator is turned to series, 80 volts produce a deflection of 300 degrees; whereas 20 volts produce a deflection of 300 degrees when the commutator is turned to parallel.

In Fig. 6 of the single bicycle-wheel voltmeter the instrument is shown with the dial vertical. But any one of the forms described in this paper may also be used with the dial either horizontal or vertical.

The action of these instruments is quite easy to understand; but the mathematical calculation of the way in which the deflection of the pointer for a given potential difference is varied by varying the dimensions of the magnifying spring, the initial sag given to the wire, and the dimensions of the wire, is not quite so easy to work out. We have, however, succeeded in reducing the solution to a comparatively simple form, and the following comprises the consideration of

A. The general formulæ and the law of graduation.
B. Waste of power in the voltmeter.
C. The range in volts of the voltmeter.
D. The greatest angular deflection of the pointer.
E. Uniformity of the scale divisions.
F. Correction for temperature.

A.—GENERAL FORMULÆ AND LAW OF GRADUATION.

Let *A O B*, Fig. 10, be one of our fine wires or two opposite spokes of our bicycle-wheel form of voltmeter, the size of the hub being neglected. Let

$$X O = O B = \tfrac{1}{2} l,$$
$$O Q = y.$$

Let the diameter of the wire be d, and the specific resistance of its material be ρ when its temperature is θ degrees

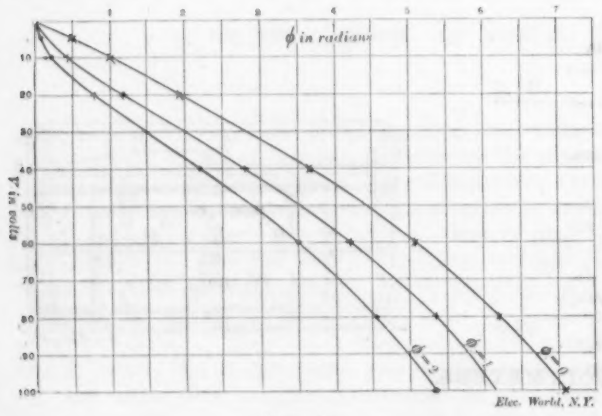


FIG. 11.

above the temperature of the surrounding metal case; then, if the case does not alter greatly in temperature,

$$\rho = \rho_0 (1 + k \theta), \qquad (1)$$

where k is the coefficient of increase of resistance per degree centigrade, and ρ_0 is the specific resistance of the material when θ is nought.

When $\theta = 0$,
let $l = l_0$,
and $y = y_0$;
then $l = l_0 (1 + \alpha \theta)$,
where α is the coefficient of increase of length per degree centigrade.

$$y^2 + A Q^2 = \tfrac{1}{4} l^2,$$
$$y_0^2 + A Q = \tfrac{1}{4} l_0^2;$$
$$\therefore y - y_0 = \tfrac{1}{2} l_0^2 \alpha \theta, \text{ approximately,} \qquad (2)$$

since α is small.

In that very useful treatise of Dr. Everett's, "Units and Physical Constants," there are given the results of Mr. McFarlane's and of Professor Tait's experiments on the rate of loss of heat in air at ordinary pressure from copper for various differences of temperature between the copper and the surrounding space, but no indication is given as to the form of the radiating body, nor of its size; and hence people have used Mr. McFarlane's results as if they applied to bodies of any shape and size, and so have been led in some cases to erroneous conclusions. As a matter of fact, Mr. McFarlane's values for the rate of loss of heat by radiation and convection given in Dr. Everett's "Units and Physical Constants" *apply only to a copper ball of 2 centimètres radius*, since this, we find, was the cooling body employed by Mr. McFarlane in the experiments in

A NEW IRON CASE BELL.

question, as mentioned in Mr. McFarlane's paper communicated by Sir W. Thomson to the Royal Society in 1870.

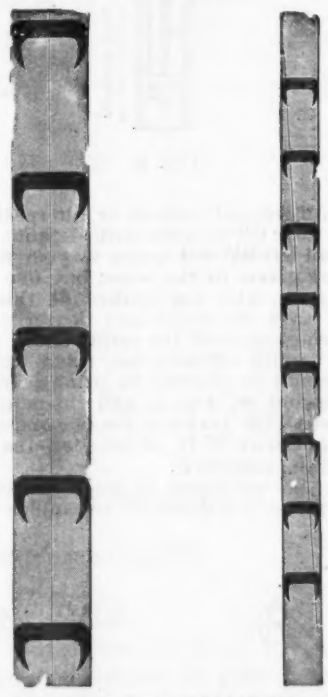
But in a very valuable book published two years previously to that—viz., in 1868—by Mr. Box, and called a "Practical Treatise on Heat," there is given a table on page 151 (which has been much used by engineers) showing the loss of heat from contact with air with horizontal cylinders and spheres. It was deduced, we rather think, from M. Peclet's experiments, and it shows clearly that the loss of heat per unit area increases as the diameter of the cylinder or sphere diminishes. Mr. Box used the Fahrenheit scale for temperature, a square foot as his unit of area, a pound for his unit of mass, and an hour for his unit of time; but, reducing his formulæ to the C. G. S. system, we find that the loss of heat (gramme, C.°) per second, per square centimètre of surface, per 1° C. excess, is

$$0.00005710 + \frac{0.0001057}{a} \text{ for a long } \textit{horizontal} \text{ cylinder,}$$

and $$0.00004928 + \frac{0.0003509}{a} \text{ for a sphere,}$$

a being in the former the radius of the cylinder in centimètres, and in the latter the radius of the sphere.

Applying Box's formula for a sphere to the case where a



WIRE SEWED BELTING FOR DYNAMOS.

is 2 centimètres, the radius of Mr. McFarlane's ball, we obtain for the loss of heat (gramme, C.°) per second, per square centimètre of surface, per 1° C. excess, the number 0.0002297—a number which is between Mr. McFarlane's value for polished copper (0.000178) and for blackened copper (0.000252). There is, therefore, every reason for believing that Box's formula is at any rate approximately correct.

Let us take as a first approximation that the rate of loss of heat is directly proportional to the difference of temperature. This we know is not strictly true, and the error arising from the assumption will be further considered under section B—"Waste of Power in the Voltmeter." Then, if $\varepsilon\ \theta$ be the heat-power *in watts* given out per square centimètre of surface of the wire when the excess of temperature is θ° C.,

$$\varepsilon = \frac{0.00005710 + \dfrac{0.0001057}{a}}{0.239}.$$

Now the resistance of the wire is $\dfrac{4\, l_0\, \rho}{\pi\, d^2}$; so that if V volts by the potential difference at its terminals, $\dfrac{V^2\, \pi\, d^2}{4\, l_0\, \rho}$ watts are developed in the wire, and $l\, \pi\, d\, \varepsilon\, \theta =$ heat-power emitted in watts; so that

$$l\, \pi\, d\, \varepsilon\, \theta = \frac{V^2\, \pi\, d^2}{4\, l_0\, \rho}; \qquad (3)$$

or

$$\theta = \frac{V^2 d}{4\, l_0^2\, \varepsilon\, \rho} \qquad (4)$$

If the thickness of the wire be very small, and if Box's formula continue to hold for very thin cylinders,

$$\varepsilon = \frac{0.0001057}{0.239\, a}, \text{ approximately;}$$
$$= \frac{0.0008848}{d}; \quad \text{"}$$

hence $$\theta = \frac{V^2\, d^2}{0.003539\, l_0^2\, \rho}, \quad \text{"}$$

so that to raise a fine wire of a given length, made of a given material, to a given temperature above that of the case of the instrument requires that the potential difference maintained at the ends of the wire shall be inversely proportional to the diameter of the wire, approximately.

If C be the current in ampères flowing through the wire,

$$C = \pi\, d^{\frac{3}{2}} \sqrt{\frac{\varepsilon\, \theta}{4\, \rho}}.$$

Substituting the value just obtained for ε for very fine wires, we have

$$C = 0.01487\, \pi\, d \sqrt{\frac{\theta}{\rho}}, \text{ approximately;}$$

or the current required to maintain a fine wire of a given material at a definite excess of temperature is approximately directly proportional simply to the thickness of the wire.

(To be continued.)

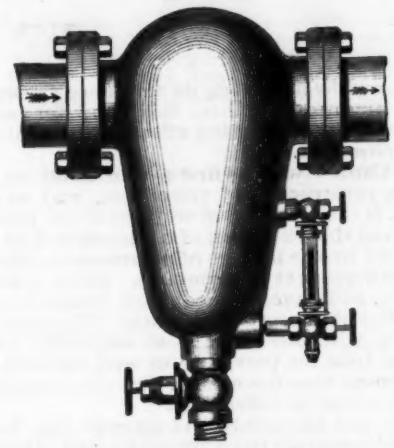


FIG. 1.—HINE'S ELIMINATOR.

Wire Sewed Leather Belting for Dynamos.

The cuts which accompany this article illustrate the peculiar method of fastening belts introduced by the Page Belting Company, and used by them extensively in the manufacture of their specialties. This wire sewing consists of a special grade of copper wire, made in a form nearly square but not exactly, pointed sharp at both ends and clinched in the manner shown. On double belts these wires or stitches are placed ¾ inch apart; on the laps of single belts, ½ inch apart.

This work is done by a machine, which is, in part the invention of Mr. George F. Page, president of the Page Belting Company. In this belt, the wire stitches being set down close into the belt as they are clinched, they present practically no metal to come into contact with the pulley, and yet the fastening is complete, for in clinching a blow tempers the metal to a degree which prevents it from unclinching. It will not push through and work out, and the clinching on both sides holds it securely in its place. This mode of fastening has now been in successful use by the Page Belting Company for about two years.

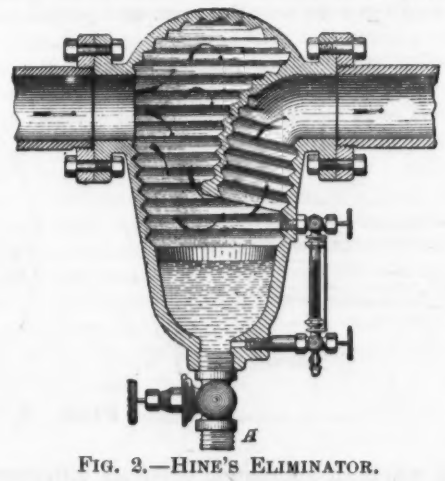


FIG. 2.—HINE'S ELIMINATOR.

A New Bell.

In order that vibrating bells may continue in service for a long time, it is necessary to exclude dust from the working parts. In the bell patented by Messrs. Edwards & Co., of this city, and illustrated in the accompanying engraving, this has been most effectually done by entirely inclosing the mechanism in an iron case, which is both dust and insect proof. The trunnion upon which the hammer works extends through the case, and the adjusting screws by which the interrupting spring and armature are regulated also pass through the case, and the binding posts for the wires are on the outside of the case. The compactness of the bell is greatly increased by plac-

ing the gong so as to almost entirely cover the inclosing case, as shown in the engraving. This admits of the bell being placed very near the ceiling, and at such a height the containing case of the mechanism is entirely out of sight. The bell is specially suited for use in mills and factories where there is much dust floating about in the atmosphere.

Hine's "Eliminator" for Electric Lighting Steam Plants.

The accompanying illustrations represent an apparatus built by Messrs. Hine & Robertson, of this city, and designed for the purpose of separating oil, grease and foreign matter from exhaust steam and also water from live steam. The apparatus is shown in perspective and section in Figs. 1 and 2, from which its operation will be understood. It is set in the exhaust pipe from engine or pump, as convenience will allow. It will be seen that the exhaust steam upon entering the eliminator instantly expands, and, impinging on the corrugated and otherwise roughened surfaces, breaks up; the entrained oil, grease and dirty water being expelled, adhere to the inner roughened surfaces, and gravitate to the bottom of the receiving chamber, and are discharged through the drain valve *A*, which should always be left sufficiently open to allow a free passage of the oil and dirty water, while the clean dry steam, deflecting from the face of the depending partition, is driven first down then upwards in continuous contact with the roughened corrugated surfaces in its course. It will be noticed that the construction is such that no back pressure can be produced by its use. The steam has opportunity to expand in the chamber, and the impinging surfaces are so arranged that the steam is broken up and brought in contact with these surfaces.

If a pipe be extended from valve *A* into a sub-receiver, such as a barrel or tank, it will be found that the oil deposited is in no way impaired and can be used over again if care be taken to keep dirt out. As considerable water from condensation is discharged with the oil, passing together into the receiving tank, the oil being the lighter will float, and can be skimmed or drained off, effecting thereby a saving of the cylinder oil, while any grit or dirt, being heavier than the water, will sink to the bottom and be carried off when draining the receiving tank.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Jan. 23, 1888.

Sugar Refined by Electricity.

Some time ago quite a sensation was caused by the announcement that sugar was to be refined by electricity. The report was treated somewhat skeptically, but it is now asserted that work will actually be done in this line. The Electric Sugar Refining Company in this city is said to be getting its plant ready for manufacturing in Brooklyn, and it will use the process invented by Mr. Henry Friend, a French-American. It is claimed that this system will convert a ton of raw sugar in two hours into perfectly hard white sugar at a cost of 80 cents a ton, and that the company intends to turn out 3,000 barrels a day of crystallized sugar of various sizes. The capital stock is a million dollars and there are 450 shareholders, including a number of those interested in the sugar business. The results in this case will be awaited with a good deal of interest; on the one side there is much apparent enthusiasm, on the other contemptuous skepticism. Mr. Lawson N. Fuller, who is well known to every New Yorker, regards the process as an astonishing discovery, while a well-known refiner says he has more confidence in the success of the Keely motor than in the manufacture of sugar by electricity.

Reflector Shades for Incandescent Lamps.

A remarkable invention for concentrating and increasing artificial light has been made recently. By its use, gas and the incandescent electric light are made to do extra work, and it is claimed that a single ordinary sixteen candle-power lamp can be made to give as much light as two lamps. The appliance is a shade, shaped like a bell, with convex sides. The whole upper surface is slightly convex and of ground glass. The rays from the light are thrown against the silver, and then reflected against the ground glass, which breaks up the rays, and the effect is a mass of light without direct rays. This shade can be attached to a gas-burner or to the incandescent electric lamp with no more trouble than an ordinary globe or shade, and the effect is purely mechanical. The light is softened and whitened by its use, and it is said that the saving in the number of lamps used can be made very large. A most brilliant light is thrown upon everything beneath the lamp and the most delicate colors of glass or pictures are shown to the best possible advantage. The shade will prove of great value to all persons engaged in literary or desk work of any kind, as the illumination is particularly soft and brilliant. One feature of the light that has been noticed is that it kills the glaze upon paper. Gas and electric lamps without the shade give a reflection from glazed paper which makes it impossible to see to write on it at certain angles. The new shade absolutely destroys this. It is possible to look at the light for any length of time without experiencing the blinding effect which an ordinary light exerts. Mr. A. A. McCreary, of 18-20 Cortlandt street, is introducing the reflector.

T. F. Hunter & Co.

I note the formation of the above firm of contractors for electric light plants and wiring, and dealers in electric light supplies, carbons, wire, etc., at 17 Dey street. The firm is composed of Mr. T. F. Hunter, who is well known in this city; Mr. W. L. Adams, formerly of the Springfield, Mass., Electric Light Company, and Mr. H. C. Willis.

Edison Electric Illuminating Company.

At a meeting of the stockholders of the Edison Electric Illuminating Company last week the following directors were elected: Edward D. Adams, John I. Beggs, C. F. Bound, C. H. Coster, Charles E. Crowell, Thomas A. Edison, J. Buchanan Henry, E. H. Johnson, I. P. Marquand, F. S. Smithers, Spencer Trask, Henry Villard, and J. Hood Wright. The former officers were re-elected.

An Edison Plant for the Broadway Road's Stables.

Mr. C. A. Benton, New York agent for the Edison United Manufacturing Company, has closed and is now installing a 600 light Edison plant for the Broadway and 7th avenue road; their premises cover the block bounded by 6th and 7th avenues, 50th and 51st streets. This will be the largest and most complete installation of its kind, one in which all the most modern and approved appliances are used. Sprague motors will be introduced for cutting and elevating hay and driving machinery in blacksmith and forge shops. This will be a notable new departure.

Men Messengers.

There appears to be a growing tendency to employ full grown men as messenger boys, and it is said that pretty nearly 200 men now find employment in one way or another in the messenger ranks, doing light porter work and errands that were formerly intrusted to under clerks. Uptown, they are in demand in the shopping districts. It is said that altogether there are not less than 4,000 boys now employed here in the district and telegraph messenger services, and that the average term of employment is about a year and a half.

Co-Operation Among Telegraphers.

The success of the Serial Building Loan and Savings Institution in this city, which was organized by the Western Union employés in 1885, is another example of the successful manner in which telegraphers can carry out plans for co-operation and self help. The Institution has just presented its third annual report, which shows that it has already issued six series of shares, and has a membership of 379, of whom 77 are borrowers. The number of shares issued to Jan. 1, 1888, is no fewer than 2,463, and the amount on bond and mortgage reaches $67,000. The Institution is in excellent shape, and is doing good work, such as to merit for it the encomiums which it has received from the New York *Star*, that paper instancing it as a typical and representative first-class building society of the kind described in its anti-rent crusade. The officers for the current year are: J. Merrihew, president; E. F. Howell, vice-president; A. R. Brewer, treasurer; W. B. Marsh, secretary; J. B. Sabine, attorney for New York; A. A. Rich, attorney for New Jersey, and John Van Horne, John Brant, D. B. Mitchell, C. P. Bruch, M. J. O'Leary, J. M. Phelan, Geo. Dauler, E. F. Cummings, Wm. Holmes, D. W. McAneeny and D. C. Sullivan, directors.

The Commercial Cable Company

has issued again this year its large and useful calendar. There is something strong and effective about such a calendar as that. It not only advertises the special merits and facilities of the company's cable system in conspicuous red lines, but it enables a man to ascertain what is the day of the month from his calendar without keeping it under his nose, or having to get up and walk 5 or 6 yards to look at it. The dates on the detachable sheets are printed in type an inch and a half long, so that without any strain one can read it easily at the distance of several feet.

The Direct United States Cable Company.

Another cable calendar recently issued is that of the Direct United States Cable Co., Limited, published here by Mr. James Brown, superintendent, at 40 Broadway. This calendar is very useful from the fact that it gives some electrical event for nearly every date, and is especially full of items that relate to cable work and progress. It is, in fact, a brief history of telegraphs, and the man who took the trouble to post himself up on it would pass as being remarkably well acquainted with the practical developments of the science.

The Westinghouse System.

Mr. D. C. Spruance, one of the most active spirits of the Marr Construction Company, reports the execution of a large amount of work for the Westinghouse Company on the alternating system throughout the South. Galveston, Tex., is increasing from 650 to 1,300 lights. Austin, Tex., takes 5,000 lights; Gainsville, 650. At Tyler, Tex., a 600-light plant has been put in for domestic and street lighting, under an exclusive contract for 25 years. Mr. Norman Marshall is in charge. At Macon, Ga., the local company is considering the installation of a 1,800-light plant. At New Orleans the Brush Company is reconstructing its station, taking out Corliss engines and substituting high speed, with new boilers, and a complete steam equipment. At Paris, Tex., the Gas Company went into the incandescent business, and intended to close its gas works, but has now made up its mind to supply both incandescent lights and fuel gas. At Fort Worth the alternating plant is to consist of 3,000 lights. At Dallas the local electric light company started in with a capital of $35,000, but was bought up for $6,000 by the gas company, which combined the two systems, and is now putting in a 5,000-light alternating plant.

A Bad Subway Accident.

On Saturday last two linemen, L. Jones and W. Harper, working in a subway manhole at Sixth avenue and Thirty-second street, were overcome by illuminating gas. One died in the subway and the other was brought out unconscious. The men were doing work for the Western Electric Company. Even admitting that the men had not adopted all the precautions they could, the fact remains that gas is one of the great troubles to contend with in subway work. We shall hear more of it yet. In the Western Union building the smell of the gas that has leaked in from the subway connections is most unpleasant. The best thing to do will be to abolish the gas altogether. It is a dangerous thing anyhow.

A Forger Caught.

Two Newark detectives arrested here last week, an accomplished German swindler, named Emil Beckman, on charges of forgery, and took him to Newark, where he was locked up. Beckman is thirty-five years old. In 1884 he was a passenger on the Hamburg steamer coming over and met Julius Bahr, a Newark electrician, who had some valuable patents. Bahr took a fancy to him and gave him a position in his factory at Newark. Beckman quickly acquired knowledge of Bahr's secrets and some time ago went to Roscoe C. Woolson, a boiler insurer, of Newark, and proposed forming a joint stock company to use Bahr's secrets in manufacturing solid and cored carbons. The company was organized and among those induced to take stock were ex-Senator Fish, Dr. Stockton, S. S. Sargent, F. T. Fearey, and others well-known in Newark. Beckman had previously taken John D. Vermilyea, a money lender, to Bahr's house, showed him the furniture which he claimed to own and borrowed $200, giving a chattel mortgage. He then took checks with the name of Woolson forged and had them cashed to the amount of $170, by local tradesmen. With this money he left Newark. When arrested checks to the amount of $1,000 with Woolson's signature forged, were in his pocket. He acknowledged his guilt.

Wanting to Pull the Wires Down.

The Board of Electrical Control met on Jan. 20 and adopted a resolution offered by Commissioner Gibbens, requesting Mayor Hewitt to instruct the Commissioner of Public Works to have the Bureau of Incumbrances remove the Western Union Telegraph wires on Sixth avenue, from Twenty-second to Fifty-eighth street; the Metropolitan and Telephone and Telegraph wires on Sixth avenue, between Twenty-second and Fifty-second streets; and the wires of the United States Illuminating Company on the north side of Twenty-fifth street, between Sixth avenue and Broadway.

Miscellaneous.

Charles A. Schieren & Co. report recent sales of leather link belting to the following concerns, for use on dynamos: Natick Electric Light Company, Natick, Mass.; Morristown Electric Light Company, Morristown, N. J.; Nashua Electric Light Company, Nashua, N. H.; South Framingham, Mass., Electric Light Company, and the Edison Illuminating Company, of New Orleans.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, Jan. 23, 1888.

New Electrical Corporations.

The Automatic Electric Service Company has established itself in commodious offices in the Chadwick Building, No. 5 Fremont street, this city.

The Electric and Machine Company of Boston was recently incorporated with a capital of $12,000. Mr. John C. Wilson is president and Mr. Lowell M. Palmer treasurer. The factory and offices of this company are on Sudbury street, just off Court street, this city.

Annual Meeting of Page Belting Company.

At the annual meeting of the Page Belting Company, at Concord, the following directors were elected: George F. Page, Charles T. Page, Sumner Wallace, T. H. Ford, Lyman D. Stevens, Henry A. Emerson and Seth M. Richards. The board organized as follows: President, George F. Page; treasurer, Charles T. Page; clerk of corporation, Daniel Barnard; clerk of board, Henry W. Stevens.

The "Wainwright" Feed-Water Heater.

The following communication was received by me this date from the Wainwright Manufacturing Company, of Boston: "Having noticed several items in your 'New England Notes' in connection with the new plant for the Rutland Electric Light Company, of Rutland, Vt., it may interest you to know that we have been favored with their order for a heater for same, of 300 h. p., this being the second order they have placed with us."

The Loomis System.

I am in receipt of advices from the Loomis Electric Manufacturing Company that the T. K. Earle Manufacturing Company, of Worcester, Mass., is having the Loomis incandescent system installed in its works, and that Messrs. S. & G. Susholz, of Schenectady, N. Y., will shortly have their factory illuminated throughout with Loomis incandescent lights.

The "Old South Lighted Up."

The above headline attracted my attention when reading yesterday's Sunday *Globe*, and I take the liberty of clipping the first paragraph of the interesting item which followed:

"Twenty brilliant electric lights adorned the steeple of the old South Church last night. Passers-by wondered why the old landmark had so suddenly become transformed. To one who entered the old church the cause of this was apparent. For months past skilled workmen have been engaged in renovating the interior of the building and in placing therein a diorama composed of 28 pictures, illustrating the life of General Grant. Yesterday Colonel Fred Grant was in this city as the guest of the Middlesex Club, and the management thought it fitting to invite him to view a work treating of his father's life."

A Telephone Exchange to be Rebuilt.

It is authentically reported that the Salem, Mass., telephone exchange is to be practically rebuilt; new lines are now being run for that purpose. The latest improved multiple switch-board will be put in.

Improvements at the Providence Telephone Exchange.

Extensive improvements are being made at the telephone exchange in the city of Providence, R. I. The old operating room will soon be replaced by much more commodious quarters on the same floor in the Butler building. The exchange is to be equipped with most modern improvements in short and long-distance telephony, including all the latest devices and apparatus.

Telephone Improvements at Boston.

The New England Telephone and Telegraph Company, of Boston, has made a change for the better in its central offices in the cities and towns surrounding Boston. At Charlestown, Somerville, Malden, Jamaica Plain and Brookline the company has equipped the exchanges with new standard switch-boards, manufactured by the Western Electric Company. At Cambridge a new multiple switch-board has been put in.

The company has just placed orders with the Western Electric also for new multiple switch-boards for Springfield and Lowell

Mass., each board to have three separate sections, with a total capacity for each exchange of 1,000 subscribers.

The Boom in the Copper Market.

The Boston *Daily Globe* in its morning edition of Saturday says: The success of the French syndicate in capturing the product of the great copper mines places the price of copper at the sweet will of this combination. It practically means that the price will not be less than 15 cents, and it may be advanced to 25 cents. The small companies can turn out ingot with a reasonable surety that for the next three years at least it can be done at a profit. Hence the activity and advance in the smaller stocks.

Cable Across Vineyard Sound.

From Vineyard Haven, Mass., comes advices that a petition has been circulated in Vineyard Haven and Cottage City, addressed to Senator Hoar, for the purpose of getting the original cable appropriation of $9,944 asked for by the chief signal officer, which was cut down to $2,000 by the acting secretary of war. This $9,944 was asked for the purpose of making a new cable across Vineyard Sound, the present cable having been badly strained by being caught on the anchors of vessels. The present sum of $2,000 is deemed insufficient, except for repairs. All the solid men of both villages on the island put down their names promptly, and the petition was forwarded three days ago. The result is looked for with great interest by all the population of Martha's Vineyard, as well as the commercial men of New York and Boston.

Bell Telephone.

The Boston *Herald* of Jan. 18 says: The Bell Company earned about 22¼ per cent. net on its capital of $9,800,000 in 1887, against rising 20 per cent. in 1886, and a little less than 18 per cent. in 1885. The gain is a plump 2 per cent. each year. It is now said that the United States Supreme Court will adjourn from Jan. 20 to March 20, which would seem to postpone decision day in the telephone suit for that period.

A Suit for Compensation.

A verdict has been rendered in the suit against Mr. E. H. Goff, of New York, President of the American Electric Manufacturing Company, for the plaintiff, Cyrus S. Haldeman, in the sum of $6,970. The plaintiff sued President Goff upon an agreement by the latter to give him $5,000 worth of stock in the American Company in consideration of his leaving the Pennsylvania Railroad Company, by whom he was employed, and accepting the place of general manager of the American Company. There was also a claim by the plaintiff that the defendant owed him $500 more for services.

The Union Telegraph and Telephone Company.

The annual meeting of the Union Telegraph and Telephone Company is called at No. 443 Broadway, Albany, N. Y., Jan. 31, to elect officers, etc. The annual report given below shows a good balance for the year, applicable to the payment of the floating debt, and if the stockholders, already schooled in patience, can still wait a few years, they may yet be made happy. Four years more like 1887 would practically cancel the $16,000 notes payable. The report is for the year ended Sept. 30, 1887, and reads:

Gross earnings	$25,217.12
Gross expenses	19,771.79
Net earnings	$5,445.33
Construction	1,618.49
Net earnings above all disbursements	$3,826.84
Number of subscribers Sept. 30, 1886	473
Number of subscribers added during the year	142
Number of subscribers taken out during the year	123
Net gain	19
Number of subscribers Sept. 30, 1887	492

Electric Subways.

The Committee on Electric Wires gave a hearing last week to Messrs. R. M. Pulsifer, H. E. Cable and F. L. Chapman, petitioners for a franchise to lay electric conduits through certain streets for a term of years. An order is to be drafted by Mr. S. L. Powers, their attorney, showing the space that the conduits would occupy. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Jan. 23, 1888.

The Electric Light Contracts.

Last month Director Wagner postponed awarding contracts to electric light companies for furnishing lights on the different highways, owing to the Keystone Electric Light Company agreeing to furnish the lights at a considerably less amount per light, providing they were granted certain concessions by councils. He subsequently entered into an agreement with the various companies to furnish the lights during the first three months of the year, so as to give him an opportunity to communicate with Councils and effect some arrangement by which the city would be benefited. At a meeting of the Electrical Committee held last Tuesday, the director's communication asking for an appropriation to pay for this service was considered. A representative of the Keystone Company was present, and stated, in answer to an inquiry, that his company was prepared to furnish lights of 2,000 candle power.

When asked why the city of Philadelphia had been compelled to pay more for electric lighting than other cities, the representative said that there were several reasons, one of which was the number of hours the light was required, and another was that if a contract were made for 2,000 c. p. lights they would be furnished and not an inferior grade. After a long discussion the question of awarding the new contracts was again referred to a sub-committee, who were instructed to report at the next meeting.

The Franklin Institute.

The annual meeting of the Franklin Institute was held at their building on Seventh street above Chestnut last Wednesday evening, the 18th, for the election of officers of the Institute for the ensuing year, and members of the Committee on Science and the Arts. There was no contest for any of the offices except for the Science Committee, for which there were sixteen nominees, and only fifteen were to be elected. The report of the Board of Managers showed that the present membership is 2,155. An appeal is made for better quarters and more financial help, and the Institute well deserves both.

The result of the election was: President, Joseph M. Wilson; vice-president, W. P. Tatham; secretary, Wm. H. Wahl; treasurer, Samuel Sartain.

Underground Telephone Privileges.

The bill granting additional underground privileges to the American Telephone and Telegraph Company of Pennsylvania (long distance telephone) was reported favorably by the sub-committee to Councils Electrical Comm'ttee last week, but after considerable discussion was recommitted. The original bill was amended by giving the company five years time in which to complete their work on both sides of the Schuylkill River, instead of one and two years as in the original bill. Permission was also to be granted for the erection of terminal poles.

Councilman McMurray opposed the measure, and said that as the concern was not a local one it should not be given such extensive privileges. Mr. Fairbank, of the company, explained that the corporation had 9¾ miles of conduit and nearly 200 miles of wire in Philadelphia, but admitted, upon being pressed by Mr. McMurray, that it had but four telephones. "We have communication," he added, "with New York, Boston, Hartford, Meriden, Springfield and others places, and it is our desire to go ahead with our work in Philadelphia as speedily as possible. We propose operating here through the Bell Telephone Company." Director of Public Works Wagner joined in the discussion, and his views created something of a sensation. "This, in my opinion, is the broadest ordinance yet considered by the Electrical Committee. It is evidently an ordinance to permit the erection of poles all over town. Read Section 2d: The company 'shall have permission to erect terminal distributing poles on certain streets.' Now read the list of streets in the original bill. They cover the city. Then, too, the ordinance allows the company to lay conduits on every street already occupied by the Bell Company. This may not be the intention of the bill, but it is clearly the effect it permits." E.

WESTERN NOTES.

Items of interest belonging to this department should be forwarded to Mr. E. L. Powers, manager of the Western Office, 44 Lakeside Building, Chicago. It is the desire and intention of THE ELECTRICAL WORLD *to devote its space to electrical news and events in all parts of the country equally, and any contributions to or correspondence for the Western Notes, tending to render them more complete and valuable, will be greatly appreciated.*

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Jan. 21, 1888.

The Chicago Telephone Company.

Last week the Chicago Telephone Company elected directors. The new board consists of John Crerar, John De Koven, John B. Drake, J. Russell Jones, C. E. Perkins, George L. Phillips, Howard Stockton, John L. Thompson and Norman Williams. The only change in the board from last year was the substitution of General Thompson's name for that of ex-Manager Fay. President Phillips said that the company was doing all it could to meet the complaints of its patrons. A meeting of the directors will soon be held, at which the trouble with the city will be discussed and some line of policy adopted.

Petersburg, Ill.

Mr. C. D. Wright, who called recently at the office of THE ELECTRICAL WORLD, informs me that he will put in an electric light plant at Petersburg, Ill., in the spring, using the Thomson-Houston system, with 25 arc lights.

A Big Galvanometer.

Mr. Forée Bain, of 76 Market street, has just completed for the United States Government on his own designs, a combined tangent, sine, cosecant and differential galvanometer. It will measure currents up to 1,000 ampères, E. M. F.'s up to 3,000 volts, and resistances up to 10,000,000 ohms. This comprehensive instrument has been on exhibition at Giles Bros. & Co.'s jewelry store, where it has attracted much attention, and it will be shipped in a few days.

Synovial Oils.

I recently called on Mr. S. Taussig, agent for the Synovial oils, who informs me that he is receiving many duplicate orders in addition to new trade. His business doubled during the past year. The uniformity of his oils has induced many electric companies to recommend them whenever putting in a new plant. The owner of a plant wrote him recently that he considers his oil more economical than the cheaper grades.

The General Outlook.

This is the season of the year when business in most lines of trade is supposed to be at a standstill, but this cannot be said at the present time of the electrical business. Dealers in supplies and promoters of the various systems of light and power inform me that sales are brisk, with a promising outlook for a rushing spring trade.

The St. Paul Ice Palace.

The St. Paul ice palace and carnival has come to be an established annual occurrence, and, as usual, many of our people will soon be flocking to that centre of midwinter gaiety. One of the special features of the ice palace, I am told, will be its illumination by electricity, with different colored lights produced by colored shades. For this purpose the Western branch of the Thomson-Houston Co. has just sold the St. Paul Co. 300 arc lights. In addition to this large sale of lights this branch has also during the present month up to the 16th inst. sold 26 dynamos which average 35 lights each. This company will soon move from its present offices in the Pullman Building into new quarters where it proposes to have a model plant. Two boilers of 80 h. p. each and two 12 × 12 engines are now being put into place which will finish the power for the Western testing and repair department.

The Shultz Belting Company.

The following is from the St. Louis *Globe-Democrat:* "The enterprise of the Shultz Belting Company, a prominent local industry, was most excellently displayed a few days ago and in a way that could not be surpassed by any similar institution in the country. It seldom occurs that such a concern is offered an opportunity to show what can be done on short notice, but the test came Saturday afternoon at 3 o'clock, when the Brush electric light plant was burned out, completely destroying all the belting of that extensive establishment. The consequence was that darkness hung over the stores of the company's patrons, and they began calling for electricity. There was no way of producing a current without belting, and as the sizes wanted were of such unusual dimensions none could be found in stock. Therefore the Shultz Belting Company began that afternoon to manufacture belting from the leather which they had on hand. By working their forces night and day they succeeded in having the Brush plant in full operation again at three o'clock Monday afternoon. In the meantime five double 12-inch, one double 20-inch, one double 24-inch, 210 feet of 12-inch, 72 feet of 20-inch, and 72 feet of 24-inch leather belting was cut, made and fitted accurately to the electric pulleys. This is the quickest job ever accomplished in this line of manufacture, and is fully in keeping with the enterprise of the firm, which is second to none in the country. Its trade is represented by agents in all the principal cities of the United States, and the factories' products are shipped to France, Holland, Mexico and even to Cairo, Egypt."

Leonard & Izard.

Messrs. Leonard & Izard, the Western representatives of the Edison Company, among other recent contracts report the following: *Herald* Publishing Company, Omaha, Neb., 150 light plant; Wm. Boddie, 175 lights; Legelbaum Bros., Minneapolis, Minn., 200 lights; First National Bank Omaha, Neb., 115 lights; wiring the Sheely Building, Omaha, Neb.; doubling the plant of O. D. Wetherell, Chicago.

The Central Electric Company.

The Central Electric Company, McKinlock Bros., who represent the Okonite Company, report that they are very busy and with an increasing trade in the okonite wire and tapes. They are putting a new wire on the market called the "Candee" aerial wire, which they claim is a superior insulated wire, having many advantages over the cheaper grades, and which seems to be meeting with favor among the trade.

The Giles Anti-Magnetic Watch Shield.

Mr. C. K. Giles, the inventor of the "Giles Anti-Magnetic Shield" for watches, recently showed me a list of 58 watches—medium priced American movement—which averaged 55 days' running each, and which showed an average variation of less than half a second per day. He tells me that the shield is growing in favor daily with electricians. An order was recently received from a watch case manufacturer for 50,000 shields.

Doings in the City Council.

In the City Council last week Corporation Council Green submitted an opinion on the question whether under the ordinance now pending before the Council the city has the right to license telephones. He held the opinion that the ordinance was illegal. Alderman Wheeler offered a resolution as follows, which was adopted:

Resolved, That the Commissioner of Public Works is hereby directed and instructed to issue no further permits to the Chicago Telephone Company to use the streets and alleys of the city of Chicago for telephone purposes until the further order of the Council.

The committee on fire and water on Saturday last recommended the adoption of the Mayor's suggestion with regard to the lighting of the river, Ashland avenue, on the south, and Fullerton avenue, on the north, by electricity. The extension of the system to street lighting seems to be looked upon with favor by most of the committee.

Rapid Transit.

At a meeting of property owners of the west side last Wednesday night, who met to discuss the matter of rapid transit, the unanimous sentiment seemed to be that Mr. Yerkes could not furnish it with his proposed cable line. The Meigs system of elevated road was favorably commented upon.

K. K. Electric Light Wire.

In new construction of electric light circuits an entire change has taken place within the last few months, and that has been the employing of wires that possessed insulation. Messrs. Holmes, Booth & Haydens, who are never behindhand in meeting the requirements of their trade, have placed upon the market their well-known "K. K." insulated wire. This is an old wire put to a new purpose, and, as every electrical man knows a time test is necessary to find out the merits of line wire, Messrs. Holmes, Booth & Haydens, with their usual conservatism, after having "K. K." wire in use for a period of nearly eight years, recommend it with confidence for its highly weatherproof qualities and fitness for withstanding abrasion, etc. Since placing this wire before the electric light trade, the entire line construction in three cities has been done with it, not one foot of underwriters' being used. The demand for this wire on alternating work is also large. Mr. J. L. Barclay, their Western representative, returned to the city after a two weeks' trip, and reports large sales of "K. K."

New Albany, Ind.

The Citizens' Electric Light Company, of New Albany, is capitalized at $50,000. It now has a 50-light American machine in operation and hopes to put in another of same capacity at once. The officers of the company are: H. S. Culbertson, president; J. K. Woodward, Jr., secretary and treasurer, and J. W. Dunbar, superintendent.

Valparaiso, Ind.

Mr. J. W. Stratton, the president and manager of the Valparaiso Gas Light Company, has contracted, in the city of Valparaiso, for arc lighting for the streets, for a term of five years, at $67.33 per month, moonlight schedule to midnight. His company has adopted the Western Electric system, and has contracted with the parent company for dynamos, lamps, circuit, etc. It starts with 28 lights for the city, 2 for the County Court-house and 6 for the railroads. It will also have about 15 or 20 commercial lights at starting. No incandescent lighting will be done at present.

The steam plant has been furnished by Russell & Co., of Massillon, O., and is now on the ground and partially in position. About a third of the poles are also set, but the work goes on rather slowly owing to severe weather. The station will be at the gas-works and Lima crude oil will be used as fuel under the boilers. A stock company has been formed, in which Mr. Stratton has associated a few gentlemen with himself, and it has

combined the two businesses of gas and electricity. The management and entire control will remain in Mr. Stratton's hands. The plant will be ready to start in about thirty days.

Electric Power in Nevada.

Electricity is to be utilized at the Paradise Valley Mine, Winnemucca, Nev., for lighting the workings and pumping water. The dynamo will be run by water power 6½ miles distant, and the current will be conveyed through wires placed on the existing telegraph poles. A motor to raise water 420 feet will be placed in the workings.

Fixtures for the Customs House, Toledo, O.

Bids for electric light and gas fixtures for the Custom House building, Toledo, O., were opened by C. S. Fairchild, Secretary of the Treasury Department, on Jan. 9, as follows: Schultz Gas Fixture and Art Metal Company, Baltimore, Md., $2,162.75; R. Hollings & Co., Boston, Mass., $3,036; the Hoen, Brannen & Forsyth Manufacturing Company, Philadelphia, Pa., $2,191.45. The contract was awarded to the Schulz Company.

Hill Clutches.

Among recent shipments announced by the Hill Clutch Works of Cleveland, O., is that of a number of friction clutches for the large electric light plant being put in by Warder, Bushnell, Glessner & Company, of Springfield, O. The works have also recently booked a large order from the Jenney Electric Light Company, of Indianapolis, for the station that company is putting in in the new Union Depot in that city. Another large order is that for friction clutch couplings and complete equipment of power transmission machinery for the plant being put in by J. W. Warner, of Oneida, N. Y.

Miscellaneous.

The Electrical Supply Company report having made some very large sales during the past week of their new "P. & B." black weather-proof line wire.

The 120 arc light plant at the corner of Blue Island avenue and 12th street, of the Van Depoele system, was recently started up and has just been sold to the Consumers' Electric Light Company.

Johnson, Holland & Co. report that they are equipping two trains on the C., B. & N. R. R. with electric light on the storage battery system.

Electric Lighting in Salt Lake City.

A correspondent, "M. C. M.," at Salt Lake City contributes the following items, which will be found of interest: The Salt Lake City Gas Company have bought the controlling interest in the Salt Lake Power, Light and Heating Company, and now have a monopoly of the lighting business here. They have not, however, taken advantage of the consumers b y raising the rates. The electric light plant consists of one 65 and two 40-light Brush dynamos and one Heisler incandescent machine. They have something over 100 arc lights in use, and about 200 incandescent. These are all used in commercial lighting. Electricity is not used for the streets here yet, although it would be just the light for the broad thoroughfares which this city possesses, the width being 120 feet from building to building. A new hotel built here last summer has an isolated incandescent plant of the Brush system. The United Electric Company was incorporated here a short time ago. The company is composed of the following ladies and gentlemen: Mr. and Mrs. C. F. Annett, Mr. and Mrs. Fenton and C. S. Smith.

An Electric Railway for Salt Lake City.

A company have petitioned the city council for right of way along Second South street for an electric street railway. The street is about four miles long and runs east and west right through the heart of the city. There are no cars on this street, and it would prove a profitable investment. I have not learned what system they intend using.

Some two or three years ago, a petition was before the council for the use of the same street for a cable road. Just at that time electricity came to the front as a motive power for street cars and the petition was withdrawn, to wait and watch the results of the new power; and now that it has proved a success and far more economical than any other power, it is the intention of introducing it here.

Mr. E. G. Holding,

who was formerly manager of the telephone exchange at Salt Lake City, is now in business for himself, being engaged in the electric bell, annunciator and gas-lighting business, and has met with very good success. He says there has been a greater demand for electric bells and annunciators during the past year than ever before, and the prospects for the present year are still better, not only for annunciators but also for isolated lighting.

Telephone Stock Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$160@	$165	Iowa Union	$25@	$26
Central Union	43@	44	Michigan	74@	76
Chicago	360@	370	Missouri and Kansas	68@	69
Colorado	19@	21	Rocky Mountain Bell	40@	45
Cumberland	62@	65	Wisconsin	108@	109
Great Southern	30@	32		E. L. P.	

SAN FRANCISCO, Cal., Jan. 9, 1888.

Lighting the Baldwin Hotel.

"Lucky" Baldwin, the millionaire proprietor of the magnificent hotel and theatre which bears his name, states that he will invest $25,000 in electrically illuminating it, putting in his own plant, including dynamos, engines and boilers. The intention is to make the theatre one of the finest in America. There will be 2,000 incandescent lamps in the theatre alone. In the hotel there will be 1,500, with a dynamo capacity of 2,000. Mr. Baldwin believes that by using the electric light throughout the building the danger of fire will be obviated.

Pacific Electric Motor Company.

The Pacific Electric Motor Company is making rapid strides. Its wires are strung throughout the city on the poles of the California Electric Light Company, the latter supplying the current. The motors are furnished at a small monthly rental, and range from $\frac{1}{10}$ h.p. upwards. Many of these are in daily use for running sewing-machines, while quite a number of from $\frac{1}{8}$ to 1 h. p. do service for driving lathes, coffee-mills and other light machinery in the various parts of the city. Some of these motor circuits are several miles in length, and do excellent service. A wood-working factory, nearly two miles from the central station, and at present using steam-power, will shortly be equipped with electric motors. This installation will, I believe, be the first of the kind on the Pacific Coast.

An Enterprising Newspaper.

That enterprising daily, the San Francisco *Examiner*, has its own plant, and illuminates the building which it occupies with incandescents. This journal has just completed another bold piece of work by placing itself in direct electrical communication with the outside world. It has its own corps of operators and its own instruments. The news from all parts of the world goes into type as fast as it is taken off the wires, and gives to the *Examiner* the distinction of being the only paper west of the Rockies possessed of such telegraphic facilities.

Improving the District Messenger Service.

The San Francisco District Telegraph Company still flourishes. It is now in connection with the Pacific Postal system, and delivers its telegrams in the same fashion that the American District does for the Western Union. The call-box system is largely used by this company, and considerable annoyance and delay has hitherto been occasioned by its unsophisticated patrons when in a great hurry. Those who have not enough patience to wait, while the box is running, until the pointer has returned to its starting place, invariably push the lever back by main force, in order to "hurry up the machine." The result is an unintelligible string of depressions in the register, and it is sometimes utterly impossible to recognize the call till the box is properly "turned in." This trouble has at last been remedied by the introduction of a new call-box having no starting lever. It is manufactured for the company by Davis & Watts, of Baltimore, and is set in operation by a slight turn of a knob projecting through the side of the case. This improvement is as ingenious as it is simple, and can not fail to relieve the company of an unbearable nuisance.

Electric Railways.

Though little is being done in San Francisco in the matter of electric railways, neighboring towns and cities are active in this matter. The Daft Railway in Los Angeles is giving complete satisfaction. San Jose is also looming up, and representatives of an Eastern company have just petitioned the Oakland City Council for a franchise to lay rails and conductors through the streets of that garden spot across the bay. And now, as if to crowd on the agony, our would-be rival, Sacramento, comes suddenly to the front. It is to have an electric railway operated on the storage plan, and it is expected that the first section will be completed by next May. Contract had been made with a San Francisco firm for the ties, to be delivered early in January, and the Pacific Rolling Mills, of this city, were under contract to have the rails out by Jan. 3. The company has definitely decided that the storage battery system will be used in operating the road, doing away with the expensive conduit, although which system will be given the preference is still a question. Two successful Eastern companies desire to obtain the contract, and each proposes to furnish a car to be run on the first section of the road, in order that their relative merits may be ascertained before the cars are purchased. And still a later "system," perfected by a local electrician, is also competing for the distinction of moving Sacramentans by means of the subtle current. This last system is to be introduced in Stockton, where a franchise has been obtained. R. N.

SOUTH AMERICAN NOTES.

CONCEPCION, Chili, Nov. 16, 1887.

The Edison System in Chili.

An Edison central station, to have an ultimate capacity of 5,000 lamps, is now being erected in Concepcion, the principal city of the south of Chili. Concepcion has a population of over 25,000, and boasts many elegant public and private buildings, and is the centre of a large wholesale business. The Edison Company have in Chili an iron-clad patent on the use of all forms of incandescent lamps and naturally are making the most of it.

Lighting at Los Angeles.

The Edison plant in Los Angeles, Chili, has been purchased by the city government and is being largely increased and street lamps established. This city is near the frontier of the territory lately occupied by the fierce Araucanian Indians, and is a curiosity in its way. Kerosene oil is so dear on account of high freight rates that the Edison light is actually cheaper than any ather form of artificial illumination, and it is not rare to see the pure rays of the incandescent carbons in miserable *ranchos* which do not possess the luxury of any better floor than Mother Earth. The contrast between American boilers, engines and dynamos and the surrounding semi-barbarism is a curious one, and some of the pioneer Edison engineers could tell tales still more curious in regard to this town. It is recorded of one of them that the first time he saw a country funeral in Los Angeles (in which the defunct is sewn up in a sack and thrown over the back of a mule, like a quarter of beef), that he started in the direction of New York on foot and was still running at last accounts.

W. N. S.

THE TELEGRAPH.

Postal Telegraphs in Congress.—Dr. Norvin Green appeared last week before the Senate Post-Office Committee in opposition to the government telegraph bills. He maintained that the government had no power to take up the business, and even if it had the service that it gave would be bad. The history of government telegraphs, he said, was noted only for tardy and blundering service, and government systems were always indifferent to prompt deliveries. If a government system were established here with rates like the English there would be an annual deficit on it of from $5,000,000 to $10,000,000. Even admitting that the Western Union Company constituted in some sense a monopoly, he denied the popular assumption that it was owned by one man. The entire board of thirty directors owned no more than three-eighths of the stock, and the other five-eighths were owned by over 3,000 people, scattered throughout every State and territory of the Union. Dr. Green was followed by Mr. G. G. Hubbard, who argued in favor of the government telegraph bill introduced by Senator Dawes.

THE TELEPHONE.

Nova Scotia.—The Nova Scotia Telephone Company, of Halifax, now has about 180 miles of long distance lines running in every direction. The work has been done by Mr. A. A. Knudson.

Elkhart, Ind.—A special dispatch says: The city council has unanimously ordered the Bell Telephone Company to remove poles and wires from the streets of the city within thirty days, and granted a franchise to the Cushman Telephone Company of Chicago.

Long Distance Work.—Superintendent Uline, at Albany, has given that city long distance telephone connections, and the results are very good. Excellent talking can be had with Boston, 350 miles off. The citizens of Albany are highly appreciative of the convenience thus afforded.

An Injunction Wanted.—A special dispatch from Birmingham, Ala., of Jan. 21, says: The Southern Bell Telephone Company to-day filed a suit in the Federal Court praying for an injunction against the Noble Pan Electric Telephone Company, of Anniston, Ala. Both companies have operated telephone exchanges in the town of Anniston for three years, and this is the first suit. The bill of the Bell Company alleges that the Pan Electric infringes on the patents of the plaintiff. The injunction has not yet been granted.

Telephones in Mexico.—A very important decision was rendered on Jan. 18, at the City of Mexico, by the first District Court of the Republic, confirming the validity of the Bell telephone and Blake transmitter patents under the laws of Mexico. It appears that a German mercantile house had been importing telephone instruments and doing business, and the firm are ordered, under the decision, to turn over all their instruments to the Mexican Telephone Company and to make an accounting. It is said that the defendants will appeal to the Supreme Court, but the belief is that the decision will be sustained.

THE ELECTRIC LIGHT.

Providence, R. I.—Local papers note the fact that the Edison Company, of New York, has ordered from the Armington & Sims Company 22 engines of 200 h. p. each.

Paterson, N. J.—The Edison Electric Illuminating Company, of Paterson, are about to instal a central station plant of 5,000 lights on the three-wire system. Mr. J. W. Schroeder has organized the company.

Owego, N. Y.—Mr. E. P. Clark has recently returned to this city from Owego, where he has been engaged putting in a plant of his system. It comprises a Clark dynamo, and 25 arcs of 2,000 c. p. The circuits also carry a number of incandescents with Baker governors, Sun electric distributors and Little-McDonald cut-outs.

Amsterdam, N. Y., is well equipped for electric lighting. The Edison Company is doing an incandescent business. The Amsterdam Arc Light Compny is furnishing the city with arc lights under a five years' contract, and does commercial lighting also. It has a 100-light Thomson-Houston plant and intends to increase its capacity.

Conshohocken, Pa.—The Conshohocken Electric Light and Power Company is operating the Westinghouse alternating current system. It not only does indoor work, but is supplying the city authorities with 100 lamps of 25 c. p. for street purposes. Its stock is $20,000. The officers are: F. H. Lubbe, president, and D. H. Ross, secretary and treasurer.

The Electric Light in Berlin.—Berlin will soon be the most brilliantly illuminated city in Europe. The electric light is being fitted all along the Unter den Linden, and the Leipziger strasse, which is upward of a mile in length, is already illuminated throughout by electricity, which is to be introduced into all the principal streets and squares.—*London Truth.*

St. Louis, Mo.—A special dispatch from St. Louis, of Jan. 21, says: The Guernsey Furniture Company, one of the biggest concerns of its kind in the city, failed to-day and made an assignment to W. H. Scudder. The assets are placed at $70,000; liabilities not known. The company was heavily interested in the electric business and conducted a large plant for distributing light.

Olean, N. Y.—Mr. C. C. Sutherland, the general agent of the Brush Electric Company, has just closed a contract with the Olean Electric Light and Power Company for a large Brush dynamo and lamps to match. The company will light the streets, and the stores and hotels as far as possible, and will fill in with incandescents. The incandescent system will not be established until the arc is well settled, and the company hopes to have 100 arcs going within six months. The company has bought a 60 h. p. Payne automatic engine and contracted for two more of the same size.

APPLICATIONS OF POWER.

Tacoma, Wash. Ty.—Tacoma's first street railroad is expected to be in use by the end of this month, the cars to be operated by electricity.

PERSONALS.

Mr. T. P. Nightingale.—The patrons of the Central New York Telephone Company will be decidedly interested in the announcement that Thomas P. Nightingale, the superintendent, has tendered his resignation to the company, which took effect the 1st day of January. They will, moreover, regret to learn that his resignation is enforced by ill health. Mr. Nightingale purposes to be identified with the hardware business in Utica, N. Y., and will introduce in that connection the sale and placing of electrical novelties. The retiring superintendent introduced the distric

messenger service in Utica in 1876, and when the telephone was brought out he took hold with characteristic energy, tact and discretion, and has been exceptionally popular with the patrons from that time down to the present. He will be missed by those he has so efficiently served.

Mr. T. Wood, the manager and secretary of the Sandusky, O., Gas Light Company and the Sandusky Electric Light and Fuel Gas Company, was interviewed here last week by a *Graphic* reporter, and expressed the opinion that incandescent gas lighting is no competitor for electricity. As to the future of electric lighting, he said: "I suppose the electric lighting people will not agree with me in my opinion on this subject. I can say to you, however, that it is my conviction that the whole system of electric lighting—both arc and incandescent—is destined in time to fall into the hands of the gas companies, for the simple and sufficient reason that they are in a position to supply these lights at a cost so much lower than any electric lighting company could furnish them with profit, that the law of competition, wherein the strongest if not the fittest survive, will eventually do the work."

Mr. Daniel J. Sprague, manager of the National Printing Telegraph Company, of No. 157 Broadway, died at his home, No. 2,011 Madison avenue, on Jan. 22. He was born in South Orange, N. J., on March 11, 1831, and was the son of the Rev. Daniel Greene Sprague, of South Orange. He was graduated at Amherst College in 1852, and studied at the Union Theological Seminary, intending to enter the ministry. His health failing, he gave up theology and went into business. In 1856 he entered the Tappan & McKillop Commercial Agency, and in 1861 the firm became McKillop & Sprague. In the same year he married a daughter of George Dayton, of Peekskill. In 1881 he became the President of the Pelham & Port Chester Railroad, and also of the Baltimore, Cincinnati & Western Construction Company. At the time of his death he was manager of the National Printing Telegraph Company, and was connected with an electric light company.

Mr. A. B. Uline.—One of Albany's well known citizens, who was in New York yesterday, is Andrew B. Uline, a six-footer, with angular figure and good natured face, whose favorite attitude is with his hands in his pockets and his silk hat tipped on the back of his head. He was an intimate friend of Daniel Manning, and when Grover Cleveland was Governor he was supposed to be in the Governor's confidence. He must be forty-five or fifty years old, yet every one knows and speaks of him as "Andy," by which no disrespect is intended, but only familiar compliment. He is a police and fire commissioner of Albany, a member of the Civil Service Board and prominent in the management of the district messenger, telephone and electric light service. "What 'Andy' Uline wants in Albany he gets," said one of his admiring friends last night, "because he never wants anything that isn't right."—*N. Y. Tribune.*

MISCELLANEOUS NOTES.

The Non-Magnetic Watch Company of America, organized under the laws of the State of New York (capital $500,000), announce that they have purchased the American business of the Geneva Non-Magnetic Watch Company, Limited, and the exclusive right to use Paillard's patent non-magnetic compensation balance and hair spring for the United States and Canada. The offices will be at 177-179 Broadway.

Things They Don't Do Better in Europe.—An English electrician to whom catalogues of the principal electrical houses of the United States were sent by request, refers to them in the following complimentary language in a letter to the editor of THE ELECTRICAL WORLD: "They are altogether very valuable and contain a lot of most useful information. I admire the way they are got up and the illustrations are splendid. You beat us easy over these things. I shall value them exceedingly."

Boycotted by Germany.—Foreign dispatches received on Jan. 23 announced that German telegraph officials had been instructed to receive no cable dispatches from this country by way of the Commercial Cable, and it was added that the American Minister at Berlin had had his attention called to the matter. Relations of the company to the French government, it was explained, had prompted this German boycott. Commercial Cable officers in this city had nothing to add to the dispatches. They expect a speedy settlement of the trouble, however, it being easy to show that the Commercial Company is wholly independent of France.

Dr. Norvin Green, being interviewed as to his expectations of government telegraphs, says: "Congress will do nothing. I don't believe either the House or the Senate committee will report any measure of this character. The scheme has been advocated for twenty-two years. So far as my observation goes the sentiment in its favor is no greater to-day than at any time within the past decade. In short, it is not growing at all. I discovered yesterday that when the Senate Committee reported unanimously in its favor four years ago at least half of the number were opposed to it as a general proposition, but voted in the affirmative only in order to get it before the Senate for discussion."

A Prisoner's Invention.—A dispatch of Jan. 11, from Houston, Tex., says: Recently an electrician named S. L. Barrett was sentenced to the county jail for a period of twenty days for using a pistol in the County Court House. While in jail he invented an instrument that he calls a micro-detector. While in working position it will warn a jailer if prisoners are attempting to escape by sawing, filing or using any other adroit means. It was tested to-day by a number of citizens, they posting themselves in a front room in the back part of the prison, with doors closed. A clock was put in motion. Every click could be distinctly heard in the room. A saw was used gently on the bars, and produced a loud sawing noise. The instrument is worked by electricity on a single wire, the various noises of the cells coming over it distinctly.

A Government Telegraph.—A dispatch from Titusville, Fla., says: The marine interests of New York will be glad to learn of the final completion of the new Government telegraph line between this point and Jupiter Inlet, 150 miles south of here. This wire is owned and controlled entirely by the United States, and is in charge of Lieut. B. M. Pursell. This officer has been supervising the construction of the line, and to-day received it from the contractors. Offices have been opened at all the principal landings on the Indian River and the east coast, as well as at Jupiter Inlet, where a United States light-house has been recently established. All vessels passing Jupiter Inlet Light-house are to be reported to the department at Washington, giving their condition and their destination. While this line is a Government institution solely, commercial messages will be received and answered at the rate of 10 cents for a message of ten words. In addition to this the Government will equip an office in any hotel on the line, and permit the use of the line free of charge upon the proprietor of the hotel furnishing an operator at his own expense.

Fire Engine Electric Motors.—The New York *Times* asks: "Why cannot fire engines be worked by electricity? Here is an idea, at all events. Surely room can be found on them for the storage of sufficient power, or the boxes of lightning might be carried by the hose carriages. In the event of the consummation of the proposition the machines would not contribute, as they do now, the greater volume of smoke at a fire. Then calculate the saving in the matter of fuel! It has got to come to this some day, and the Commissioners might as well begin to consider the suggestion. Notification of the breaking out of a fire is given by electricity, and its extinguishment might as well be done by the same agency. Of course, the idea will be pooh-poohed, but that is no reason why it should not be considered. All improvements or proposed improvements have to overcome fierce opposition. A hand-engine to-day seems a mockery. It is a curiosity. Electric motors will yet put the steamer beside the old goose-neck fire engines." This idea, we may say, is already being carried out.

BUSINESS NOTICES.

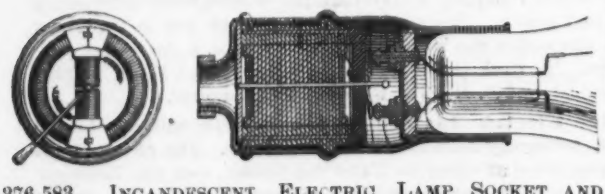
Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JANUARY 17, 1888.

376,423. Car Lighting; C. R. Arnold, Brooklyn, N. Y. Application filed March 29, 1886. The current is generated by a dynamo which is driven by an engine located in an apartment in one end of the car. Hydrocarbon is used in the furnace to generate steam for the engine. The partition between the two compartments is made of material which will deaden the sound of the machinery.

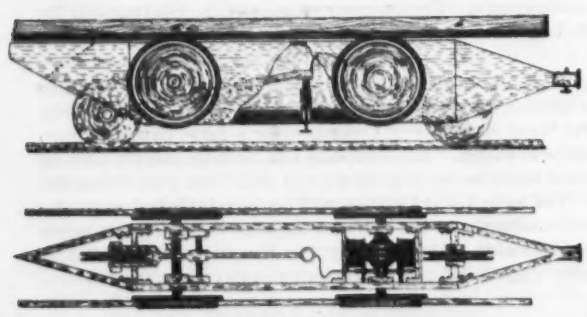
376,429. Tube Motor Street Railway; W. G Creighton, Norwood Park, Ill. Application filed Dec. 21, 1885. A large tube is laid underground between the tracks in which an elec-



376,583. INCANDESCENT ELECTRIC LAMP SOCKET AND ELECTRICAL CONVERTER.

tric motor runs and is connected through a slot with the car above by suitable levers. The motor in the tube drags the car after it.

376,541. Mechanism for Electrically Controling Stamping Machines; O. Mergenthaler, Baltimore, Md.



376,567. ELECTRIC RAILWAY SYSTEM.

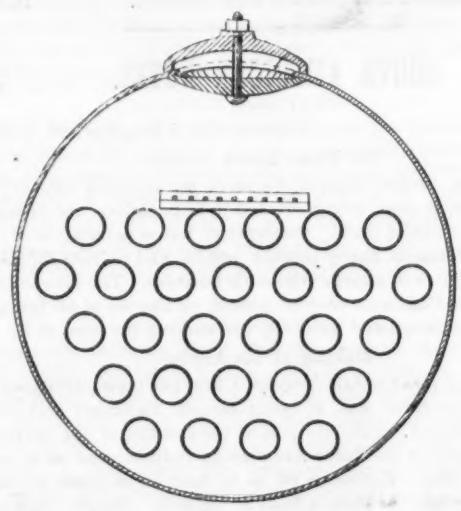
Application filed May 28, 1887. The circuit controling device which controls the electro-magnetic mechanism is itself controled by its contact with the object undergoing formation.

376,562. Electric Conduit; R. Van Buren and J. J. Powers, Brooklyn, N. Y. Application filed Oct. 21, 1887. The conduit is in sections, one end of each section is enlarged to receive the reverse end of the adjoining section, and the other end is provided with a series of tubulations or extensions.

376,567. Electric Railway System; D. G. Weems, Baltimore, Md. Application filed March 21, 1887. This is a small automatic car or train of cars for carrying mail or small packages. It runs on any railroad, and in combination with the proper mechanism located on the road switches itself and operates its own brakes.

376,569. Telegraphic Apparatus; S. B. Whitehead, San Francisco, Cal. Application filed Aug. 9, 1887. The instruments are inclosed in a muffled box to prevent the sound being heard, and a tribe with attachments is provided for conducting the sound to the ears of the operator,

376,579. Prevention of Incrustation in Steam Boilers; C. J. T. Burcey, Syracuse, N. Y. Application filed Sept. 9, 1887. A pan of iron or copper, having an open top and perforated sides, and a slab of zinc seated flatwise in the pan. These two metals, by contact with the water, set up a



376,579. PREVENTIVE OF INCRUSTATION IN STEAM BOILERS.

galvanic action which prevents incrustation of the boiler. See illustration.

376,583. Combined Incandescent-Electric Lamp Socket and Electric Converter; E. A. Colby, New Haven, Conn. Application filed March 18, 1887. A converter is placed in the lamp socket, consisting of an annular core provided with coils of insulated wire. Within this core there is placed a second core, preferably of the shape of the Siemens armature. The second core is also provided with a coil of insulated wire. The annular core is provided on opposite ends with two enlargements projecting inwardly beyond the coils, and the inner core is mounted in such a manner that its ends may be turned toward and from such projections to vary the current. See illustration.

376,601. Laryngoscope; J. Leiter, Vienna, Austria-Hungary. Application filed May 14, 1887. An incandescent lamp is arranged in connection with a laryngoscope in such a manner that its rays are thrown into the orifice to be examined.

376,615. Support for Telephone Receivers; W. E. Thurber and J. McConnell, Cleveland, O. Application filed Aug. 31, 1887. A series of pivoted levers having locking devices at the joints to fix the levers in any desired position. The outer end carries the receiver.

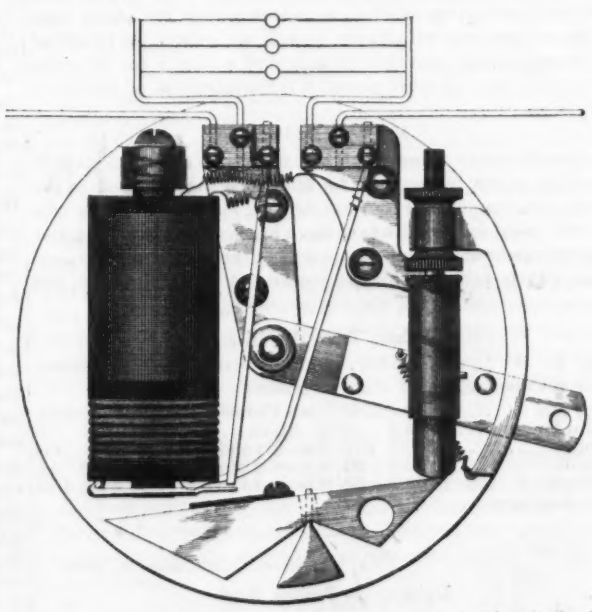
376,617. Combined Gas and Electric Light Fixture; S. B. H. Vance, New York, N. Y. Application filed Jan. 31, 1887. The fixture has separate passages for the gas and the wires, the invention being in the manner of running the separate passages through the joints to connect with those in the tube portions of the fixture.

376,630. Electro-Magnetic Device; C. F. Brush, Cleveland O. Application filed Dec. 10, 1885. The first claim describes the invention as follows: The combination, with a helix included in an electric circuit and an armature, of a supplemental actuating device constructed and arranged to operate slowly through a predetermined distance and assist the helix in moving the armature gradually to a predetermined distance from the helix, and then to release the armature to the sole action of the helix. See illustration.

376,651. Automatic Electric Valve; C. J. Hexamer, Philadelphia, Pa. Application filed Oct. 4, 1887. A clock, electric circuits and magnets are so arranged in relation to each other and to the valves that the last are opened and closed periodically.

376,661. Telegraph Repeater; J. Kölzer, Duisburg, Prussia, Germany. Application filed April 8, 1886. A commutator having six plates, four holes and two plugs is utilized, whereby the main line circuits may be united or separated.

(1), 376,706; (2), 376,707. Magneto Telephone; F. H. Brown, New York, N. Y., Assignor to the Magneto Telegraph



376,630. ELECTRO-MAGNETIC DEVICE.

Company, of New York. Applications filed respectively March 31 and Feb. 20, 1886. (1) A transmitter having a magnet provided with arms of unequal magnetic strength, the diaphragm secured magnetically to the weaker pole and free to vibrate over the stronger. (2) Structural details.

376,709. Electro-Magnetic Brake; N. J. Clute, Schenectady, New York. Application filed Oct. 26, 1887. Two U-shaped magnets are provided, each having their poles secured to a separate brake shoe. The magnets are magnetically insulated from each other, but electrically connected. The object of the invention is to use both the north and south poles of each magnet on each car wheel, thereby doubling the amount of power.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.